This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LANE MEDICAL LIBRARY STANFORD
2 45 0171 8261

LANE
MEDICAL LIBRARY
SEAL OF THE LELAND STANFORD JUNIOR UNIVERSITY
SEMPER VIRENS
1885
Gift of Dr. Barkan

DISEASES
OF THE
NOSE, THROAT, AND EAR

BISHOP

DISEASES

OF THE

NOSE, THROAT, AND EAR

AND

THEIR ACCESSORY CAVITIES

BY

SETH SCOTT BISHOP, M.D., D.C.L., LL.D.

Author of "The Ear and its Diseases."

Honorary President of the Faculty and Professor of Diseases of the Nose, Throat, and Ear in the
Illinois Medical College; Professor in the Chicago Post-graduate Medical School and Hospital;
Surgeon to the Post-graduate Hospital and to the Illinois Hospital; Consulting Surgeon to
the Mary Thompson Hospital, to the Illinois Masonic Orphans' Home, and to the
Silver Cross Hospital of Joliet; Formerly Surgeon to the Illinois Charitable Eye and Ear Infirmary, to the South-side Free Dispensary,
and to the West-side Free Dispensary; Editor of the
Illinois Medical Bulletin; One of the Editors
of the Laryngoscope, etc.

Third Edition. Thoroughly Revised and Enlarged

Illustrated with Ninety-four Colored Lithographs and Two
Hundred and Thirty Additional Illustrations

PHILADELPHIA
F. A. DAVIS COMPANY, PUBLISHERS
1904
W

COPYRIGHT, 1904,
BY
F. A. DAVIS COMPANY.

[Registered at Stationers' Hall, London, Eng.]

Philadelphia, Pa., U. S. A.
The Medical Bulletin Printing-house,
1914-16 Cherry Street.

B62
1904

TO

PROF. NICHOLAS SENN, M.D., Ph.D., LL.D.,

IN RECOGNITION OF HIS DISTINGUISHED
SERVICES

IN THE

ADVANCEMENT OF SURGERY,

THIS BOOK

IS

AFFECTIONATELY DEDICATED

BY

THE AUTHOR.

94693

PREFACE TO THE THIRD EDITION.

THE second edition of this work, and the several reprints of it, were sold in so short a time after their publication that a revision seemed uncalled for; but the increasing literature and the introduction of new remedies, methods of treatment, and improved instruments and apparatus render the time ripe for recasting much matter and introducing the new.

Another chapter and many new articles and illustrations have been added, and wherever our present knowledge appeared to justify the omission of material to make room for more important matter it has been done. Several chapters have been condensed, and a number of subjects have been wholly or partly rewritten, amplified, and illustrated. Recent discoveries and many helpful quotations and references to current literature have been added. Indeed, no effort has been spared to make this edition thoroughly representative of the most advanced work to the time of publication.

Since by far the larger part of this volume is devoted to the nose and throat, it has been deemed advisable to indicate that fact by the present change in the title, according to which the division on the ear is placed last. More especially was this desirable in order that this book might not be confused with the writer's more complete work on "The Ear and its Diseases."

American readers are so impatient of prolixity that the writer has not hesitated to sacrifice the euphony of diction to the utility of concise information. Especial care has been taken to represent the latest and most valuable work of Americans, as well as of foreign writers, for our own countrymen are too often overlooked, and their conscientious and meritorious labor meets with too little encouragement at home as well as abroad. Within the limited compass of this book the writer has endeavored to recognize merit wherever it was found—to be just toward all and generous toward his peers.

The pleasant duty remains of expressing my sincere appreciation of the generous adoption of this work, not only by the general practitioners, but by my fellow-teachers in a very large number of the medical colleges. I have earnestly striven to meet their requirements and to merit their approval.

S. S. B.

103 STATE STREET, CHICAGO.

PREFACE TO THE SECOND EDITION.

THE early exhaustion of the first edition has afforded a welcome opportunity to add many desirable improvements in the second. The writer is under deep obligations for the cordial reception and generous criticism of the book by the medical press and profession. Many of the excellent suggestions made by the reviewers, who are largely teachers in this branch, have been acted upon, with the result of incorporating new subjects and much other new and valuable material.

The generally expressed wish for enlargement and greater detail in the treatment of various diseases has been met, as far as could consistently be done. Two new chapters have been written, one on "Related Diseases of the Eye and Nose," and the other on "Life-insurance Affected by Diseases of the Ear, Nose, and Throat." Illustrated articles on "Direct Laryngoscopy, or Autoscopy"; and on "Pachydermia Laryngis," etc., have been added. Many new colored drawings and half-tone engravings from photographs of interesting and instructive cases, specimens, and preparations have been made for this edition.

It was the original purpose to condense as much indispensable information as possible in a book of convenient size for students and general practitioners, and it has been found practicable to hold to this method while making the additions of new matter, to the extent of more than 25 per centum, by utilizing to the highest advantage the arts of lithography, engraving, and printing.

Instead of devoting the usual large space to descriptive anatomy, this subject is profusely pictured in close association with the diseases treated of, and the many illustrations, together with their accompanying explanations, keep the various organs, their surgical relations, and their varying appearances in health and disease always before the eye. It is believed that, with the more extended treatment of the most important subjects and their ample illustrations, this volume will meet with even a more cordial favor among the specialists than the first edition was fortunate enough to enjoy.

For valuable services in preparing illustrations for the second edition the writer desires to express his acknowledgments and thanks to Professor Politzer for his permission to reproduce a number of his artistic colored figures; to Mr. Ready, the medical artist, for colored drawings; to Max Thorner for illustrations of direct laryngoscopy; and to E. S. Talbot and C. W. Baker for photographs.

Moved by the kind welcome accorded to the first edition, the writer has earnestly endeavored to make the second issue more fully and satisfactorily meet the requirements of a magnanimous profession.

S. S. B.

103 State Street, Chicago.

PREFACE TO THE FIRST EDITION.

FREQUENT requests from medical students and general practitioners for a book on diseases of the ear, nose, and throat especially adapted to their needs have prompted the writer to endeavor to meet this demand.

This work was designed, first, to help students in preparing for their degree; second, for those progressive practitioners who wish to acquire the proficiency necessary to properly treat those patients who are unable to visit specialists; and, third, for those who are gradually exchanging their general practice for special work in these branches.

The subjects are simplified and condensed so as to constitute this book a key, or introduction, to the exhaustive treatises already in the field. The place of the latter is not expected to be filled by this unpretentious book, for it was not intended primarily for specialists. Yet it is hoped that it may modestly serve their interests in bringing information on the subjects down to the present date, and as a work of ready reference.

Several subjects are treated in greater detail than characterizes the work as a whole, for the following reasons: No book, equivalent to this, is now available containing the latest developments concerning diphtheria, the blood-serum therapy, the medical and surgical management of mastoid diseases, the related diseases of the eye and nose, the most successful treatment of hay fever, the improved compressed-air instruments, vaporizing apparatus, inhalents, etc. Therefore these subjects are given especial prominence. The opinions and experiences of a large number of eminent authorities are presented on the subjects of diphtheria, antitoxin therapy, and hay fever.

Like works on general medicine and surgery, little space is devoted to the anatomy of the various organs. It is assumed that the reader either has a fair understanding of anatomy or possesses such a book for reference. This fact, taken with the use of the descriptive illustrations, permits the devotion of most of our pages to diseases and their treatment. The new atlas of colored drawings by Professor Politzer is recommended as an aid in the study of middle-ear diseases.

The writer has freely consulted many books and journals, and desires to fully and frankly acknowledge his very great indebtedness

CONTENTS.

PART I.

DISEASES OF THE NOSE.

CHAPTER I.

PAGE

EXAMINATION AND INSTRUMENTS 3

Examination of patients. Instruments. Atomizers. Vaporizers. Sprays. Inhalents. Inhalers.

CHAPTER II.

DISEASES OF THE NASAL CAVITIES 17

Influenza. Acute rhinitis, or coryza. Simple chronic rhinitis. Chronic nasal catarrh. Cerebro-spinal rhinorrhœa.

CHAPTER III.

DISEASES OF THE NASAL CAVITIES *(Continued)* 29

Hay fever. The neurotic theory. Uric acid as a cause of hay fever. Predisposing and aggravating causes.

CHAPTER IV.

DISEASES OF THE NASAL CAVITIES *(Continued)* 44

Hay fever *(continued)*. Symptomatology. Diagnosis. Prognosis. Abortive treatment. Local self-treatment. Preventive treatment. Hygienic measures. Symposium of medical opinions.

CHAPTER V.

DISEASES OF THE NASAL CAVITIES *(Continued)* 57

Hypertrophic rhinitis. Electrocautery apparatus. Surgical dynamomotors. Operations for hypertrophies. The nose and the female sexual organs. Atrophic rhinitis, or dry catarrh. Ozæna.

CHAPTER VI.

DISEASES OF THE NASAL CAVITIES *(Continued)* 76

Epistaxis, or nose-bleeding. Mucous polypi. Fibrous polypi. Cystic polypi. Papillomata. Erectile tumors. Chondromata. Osteomata. Exostoses. Rhinoliths. Sarcomata. Carcinomata.

CHAPTER VII.

DISEASES OF THE NASAL CAVITIES *(Concluded)* 86

Tuberculosis of the nose. Syphilis of the nose. Lupus of the nose. Glanders. Furunculosis. Anosmia. Parosmia. Deformities and diseases of the nasal septum. Blood-tumors of the nasal septum. Abscess of the septum. Perforation of the septum. Fractures of the nose. Congenital deformities of the nose. Foreign bodies in the nose. Animate objects in the nose.

CHAPTER VIII. PAGE

DISEASES OF THE ACCESSORY CAVITIES OF THE NOSE 104

Inflammation of the antrum of Highmore, or maxillary sinus. Ethmoid diseases. Sphenoid diseases. Diseases of the frontal sinuses.

CHAPTER IX.

RELATED DISEASES OF THE EYE AND NOSE 116

Diseases of the eye caused by nasal affections. Ocular reflexes from nasal diseases. Nasal diseases due to ocular anomalies.

CHAPTER X.

DISEASES OF THE NASO-PHARYNGEAL CAVITY 128

Naso-pharyngeal catarrh. Atrophic catarrh of the naso-pharynx. Fibrous tumors of the naso-pharynx. Fibromucous polypi of the naso-pharynx. Malignant tumors. Adenoid vegetations in the vault of the pharynx.

PART II.

DISEASES OF THE PHARYNX.

CHAPTER XI.

DISEASES OF THE PHARYNX 147

Acute pharyngitis, or simple sore throat. Simple chronic pharyngitis. Acute rheumatic pharyngitis. Chronic rheumatic sore throat.

CHAPTER XII.

DISEASES OF THE PHARYNX *(Continued)* 159

Sore throat of measles, scarlet fever, and small-pox. Follicular pharyngitis. Membranous sore throat, non-diphtheric.

CHAPTER XIII.

DISEASES OF THE PHARYNX *(Continued)* 167

Diphtheria. Pathology. Etiology. Symptomatology. Diagnosis. Prognosis.

CHAPTER XIV.

DISEASES OF THE PHARYNX *(Continued)* 177

Diphtheria *(continued)*. Treatment. Examination of diphtheric patients. Isolation. Local and constitutional treatment.

CHAPTER XV.

DISEASES OF THE PHARYNX *(Continued)* 187

Diphtheria *(concluded)*. Serum-therapy, or the antitoxin treatment of diphtheria. The production and action of antitoxin. The time and methods for using antitoxin. The dosage. The results of blood-serum therapy.

CHAPTER XVI.

PAGE

DISEASES OF THE PHARYNX *(Continued)* 198

Tonsillitis. Phlegmonous tonsillitis. Hypertrophy of the tonsils. Tonsillotomy. Instruments and methods of operating. Hæmorrhage following removal of the tonsils. The lingual, or fourth, tonsil.

CHAPTER XVII.

DISEASES OF THE PHARYNX *(Continued)* 214

Mycosis, or parasitic disease of the pharynx. Concretions in the tonsil. Non-malignant tumors of the pharynx. Adhesions of the soft palate to the pharyngeal walls. Uvulitis. Bifid and double uvulas. Tuberculosis of the pharynx. Syphilis of the pharynx. Cancer of the pharynx.

CHAPTER XVIII.

DISEASES OF THE PHARYNX *(Continued)* 229

Anomalies and new growths. Malformations and deformities. Stenosis. Dilatation. Papilloma. Cystoma. Carcinoma. Fibroma. Lipoma. Angioma. Sarcoma.

CHAPTER XIX.

DISEASES OF THE PHARYNX *(Concluded)* 240

Retropharyngeal abscess. Neuroses of the pharynx. Neuroses of sensation. Hyperæsthesia. Anæsthesia. Paræsthesia. Neuralgia. Neuroses of motion. Spasms of the pharynx. Globus hystericus. Pharyngeal chorea. Paralysis of the pharynx. Burns and scalds of the pharynx. Foreign bodies in the pharynx.

PART III.

DISEASES OF THE LARYNX.

CHAPTER XX.

DISEASES OF THE LARYNX 251

Indirect laryngoscopy. Instruments. Apparatus. Difficulties of laryngoscopy. Direct laryngoscopy, or autoscopy.

CHAPTER XXI.

DISEASES OF THE LARYNX *(Continued)* 261

Acute laryngitis.

CHAPTER XXII.

DISEASES OF THE LARYNX *(Continued)* 267

Croup. Comparison of true croup with laryngeal diphtheria.

CHAPTER XXIII.

DISEASES OF THE LARYNX *(Continued)* 273

Intubation of the larynx. Instruments, method, and results. Care and feeding of patients. Tracheotomy.

CHAPTER XXIV. PAGE

DISEASES OF THE LARYNX *(Continued)*.............................. **283**

Chronic laryngitis. Atrophic laryngitis. Suppurative laryngitis. Abscess of the larynx. Trachoma of the vocal cords. Œdema of the larynx.

CHAPTER XXV.

DISEASES OF THE LARYNX *(Continued)*.............................. **296**

Neuroses. Spasmodic croup. Anomalies of sensation. Nervous aphonia. Reflex affections of the voice. Paralyses.

CHAPTER XXVI.

DISEASES OF THE LARYNX *(Continued)*.............................. **304**

Tuberculosis of the larynx. Syphilis of the larynx.

CHAPTER XXVII.

DISEASES OF THE LARYNX *(Concluded)*.............................. **312**

Tumors. Innocent tumors. Papillomata. Fibromata. Pachydermia laryngis. Miscellaneous growths. Malignant tumors. Carcinomata. Sarcomata. Foreign bodies in the larynx.

PART IV.

DISEASES OF THE EAR.

CHAPTER XXVIII.

A GENERAL CONSIDERATION OF DISEASES OF THE EAR, NOSE, AND THROAT BASED ON A STUDY OF TWENTY-ONE THOUSAND CASES **331**

Etiology.

CHAPTER XXIX.

EXAMINATION OF PATIENTS.. **338**

Instruments and apparatus. Tests for hearing. Recording cases. Forms for case-records.

CHAPTER XXX.

COMPRESSED-AIR APPLIANCES AND THEIR USES.......................... **356**

Accurate methods of treatment with compressed air. High- and low- pressure devices. How to use high pressure safely. The advantages of improved air-condensers over rubber bags. Details of treatment with air- meters, or regulators.

CHAPTER XXXI.

METHODS OF PRODUCING AND USING COMPRESSED AIR. **363**

Useful devices for hand- and water- power pressure. Politzerization. Catheterization. Auscultation.

CHAPTER XXXII. PAGE

DISEASES OF THE EXTERNAL EAR 375

Frost-bite. Eczema. Lupus. Gangrene. Carcinoma. Perichondritis. Hæmatoma. Cystoma. Intertrigo. Herpes. Pemphigus. Syphilis. Deformities of the auricle. Hypertrophied auricle. Scroll-ear and associated deformities.

CHAPTER XXXIII.

DISEASES OF THE EXTERNAL AUDITORY CANAL 384

Inspissated and impacted cerumen. Diffuse inflammation of the external meatus. Furunculosis. Parasitic inflammation, or otomycosis. Exostoses. Imperforate meatus. Foreign bodies in the meatus.

CHAPTER XXXIV.

DISEASES OF THE MIDDLE EAR 396

Injuries to the drumhead. Inflammation of the drumhead. Eustachian tubal catarrh, or salpingitis. Acute inflammation of the middle ear.

CHAPTER XXXV.

DISEASES OF THE MIDDLE EAR *(Continued)* 407

Acute suppurative inflammation of the middle ear. Chronic non-suppurative inflammation of the middle ear. Hypertrophic, or secretive, catarrh of the middle ear.

CHAPTER XXXVI.

DISEASES OF THE MIDDLE EAR *(Continued)* 418

Adhesive inflammation of the middle ear.

CHAPTER XXXVII.

DISEASES OF THE MIDDLE EAR *(Continued)* 433

Operative treatment of tympanic adhesive inflammation. Mobilization of the ossicles. Incision of the posterior fold of the drumhead. Multiple incisions of the drumhead. Excision of areas of the drumhead. Division of the tensor tympani. Excision of the membrana tympani and ossicles. Operation for excision of the ossicles. Mobilization of the stirrup. Stapedectomy.

CHAPTER XXXVIII.

DISEASES OF THE MIDDLE EAR *(Continued)* 445

Chronic suppurative inflammation of the middle ear. Aspiration of the tympanic cavity.

CHAPTER XXXIX.

DISEASES OF THE MIDDLE EAR *(Concluded)* 456

Sequels of middle-ear inflammation. Granulations. Polypi. Caries and necrosis of the tympanic cavity. Necrosis of the ossicles. Adhesions, cicatrices, and perforations of the membrana tympani. Artificial drumheads. Deafness following suppuration. Tinnitus in purulent inflammation. Cholesteatoma. Facial-nerve paresis and paralysis. Carious processes in the temporal bone. Hæmorrhage. Pyæmia. Sequestra.

CHAPTER XL.

PAGE

EXTENSION OF EAR DISEASES TO THE CRANIAL CAVITY 472

Meningitis. Extradural abscess. Cerebral abscess. Cerebellar abscess. Operations for brain-abscesses. Sinus-phlebitis and sinus-thrombosis.

CHAPTER XLI.

DISEASES OF THE MASTOID PROCESS 479

Medical treatment. Surgical treatment. Indications and preparations for mastoid operations. Preparation of patient. Instruments required. Preparation of instruments.

CHAPTER XLII.

THE MASTOID OPERATIONS 492

The Schwartz operation. The radical tympano-mastoid, or Stacke, operation. The modified mastoid operation. Abscess of the neck from middle-ear and mastoid suppuration.

CHAPTER XLIII.

DISEASES OF THE INTERNAL EAR 514

Hyperæmia and anæmia of the labyrinth. Inflammation of the labyrinth. Panotitis. Hæmorrhage into the labyrinth. Ménière's disease. Leucocythæmic deafness. Syphilis of the labyrinth. Diseases of the auditory nerve. Neuroses of the perceptive apparatus. Hyperaudition. Hyperæsthesia. Paracusis. Paracusis Willisii. Subjective sounds, or tinnitus aurium. Nervous tinnitus. Spasmodic noises. Paresis and paralysis of the auditory nerve. Cerebral causes of deafness. New growths of the internal ear.

CHAPTER XLIV.

DISEASES OF THE INTERNAL EAR (*Concluded*) 525

Injuries to the labyrinth. Deaf-mutism. Education of the deaf. Hearing-instruments.

CHAPTER XLV.

LIFE-INSURANCE AFFECTED BY DISEASES OF THE EAR, NOSE, AND THROAT 533

APPENDIX.

REMEDIES 539

INDEX 549

LIST OF ILLUSTRATIONS.

FIG. PAGE
1. Convenient Arrangement for Treatment Room 2
2. Electric Illuminator, as Used in Posterior Rhinoscopy 3
3. Nasal Speculum of Correct Pattern, and the Proper Way to Handle it 4
4. Bosworth's Tongue-depressor 5
5. Throat-mirrors 5
6. White's Palate-holder 6
7. Sajous's Soft-palate Elevator 6
8. The Posterior Rhinoscopic Image 7
9. The Davidson Spray-producers 8
10. The De Vilbiss Atomizer 9
11. The Lavolin Atomizer 9
12. Truax, Greene & Company's Atomizer 10
13. Andrews's Combined Atomizer and Vaporizer 10
14. The Globe Vaporizer 11
15. The Globe Nebulizer 12
16 to 21. Methods of Receiving Sprays and Inhalents 12
22. Hot-water Inhaler 15
23. The Author's Camphor-menthol Inhaler 15
24. The Author's Soft-rubber Nasal Bougie 26
25. Nasal Synechia 57
26. Posterior View of Osseous Bridge Shown in Fig. 25 58
27. Transverse Vertical Section through the Vault of the Pharynx and Eustachian Tubes 59
28. Transverse Vertical Section through the Posterior Nares 60
29. Transverse Vertical Section through the Orbits, Nasal Fossæ, and Maxillary Antra 61
30. Transverse Vertical Section through the Nasal Fossæ 62
31. The Wabash Cautery Battery, with Electrodes, Lamp, and Handles. 63
32. The American Storage Battery 64
33. Electric-current Transformer and Dynamomotor 65
34. Alternating Electric-current Transformer for Cautery Purposes 66
35. Cautery-knife 67
36. McIntosh Electrocautery Handle, with Snare and Windlass 67
37. Hobby's Steel Snare 69
38. The Author's Septum-knife 70
39. Electric Drills 70
40. Electric Trephines 71
41. The Author's Nasal Saws 71
42. Bellocq's Cannula Introduced 77
43. Curette-forceps 78
44. Very Strong Cutting Forceps 79
45. Casselberry's Saw-tooth Scissors 80
46. Fragments of a Rhinolith, Exact Size, Weighing Seventy-one Grains, from a Woman Fifty-nine Years Old 83
47. Destruction of the Hard Palate, the Soft Palate Remaining Unharmed 84
48. Destruction of the Bones Forming and Supporting the Bridge of the Nose 87
49. Partial Destruction of the Bones of the Nose, Resulting in Two Perforations 88

FIG. PAGE
50. The Author's Nasal Supporter 89
51. Moderate Deflection of the Septum Nasi 94
52. Deflection of Septum Nasi Sufficient to Cause Stenosis of the Left Naris 95
53. Deflection of Septum Nasi toward the Right Side, at nearly a Right Angle 96
54. Deflection of Septum Nasi toward the Left Side with Apparent, but not Real, Adhesion to the Left Inferior Turbinated Body 97
55. Perpendicular Portion of the Ethmoid Bone, consisting of Two Plates; the Inferior Turbinated Bone of the Left Side is Plainly Visible 98
56. Transverse Vertical Section through the Nasal Fossæ 99
57. Transverse Vertical Section through the Nasal Cavities 100
58. Hartmann's Forceps 102
59. Transverse Vertical Section through the Nasal Fossæ and Maxillary Antra 104
60. Transverse Vertical Section of the Nasal Fossæ 105
61. Transverse Vertical Section through the Maxillary Antra 106
62. Transverse Vertical Section through the Maxillary Antra 107
63. Cannula and Trochar 108
64. The Author's Antrum and Ethmoid Irrigator 109
65. Longitudinal Vertical Section (Actual Size) through the Nasal and Accessory Cavities 111
66. Longitudinal Vertical Section (Natural Size) through the Nasal and Accessory Cavities 113
67. Dissection showing Nasal Duct and its Relations 117
68. Ducts Connecting the Nose with the Accessory Sinuses and the Eye 119
69. Lacrymal Knife 124
70. Contracted Upper Jaw; Narrow Roof of Mouth with very High Arch, Encroaching upon the Nasal Fossæ 135
71. A Mouth-breather 137
72. Denhart's Mouth-gag 138
73. Position of Child for Adenoid Operation or Intubation; Mouth-gag Introduced 139
74. Gottstein's Ring-curette 140
75. Diphtheria Bacilli 168
76. Diphtheria Bacilli 169
77. Streptococcus Pyogenes 170
78. The Author's Tonsillotome, with Excised Tonsil 207
79. Bifid Uvula in a Man Sixty Years Old 216
80. Complete Double Uvula in a Boy of Fourteen Years 218
81. Large Perforation of the Velum Palati 223
82. Destruction of the Velum Palati 225
83. Small Powder-blower with Long Tube 227
84. Stenosis of the Pnarynx 230
85. Mackenzie's Lateral Throat-forceps 246
86. De Vilbiss Illuminator 252
87. The Author's Epiglottis Retractor 255
88. Position for Autoscopy 256
89. Tongue-depressor for Pharyngoscopy and Direct Laryngo-tracheoscopy 257
90. Tangential Plane 257
91. Standard Spatulas 258
92. Types of Instruments for Autoscopic Operations 259
93. O'Dwyer's Intubation-tubes 273
94. Scale 273
95. O'Dwyer's Introducer, with Tube Attached 274
96. O'Dwyer's Extractor 275
97. Roswell Park's Aluminium Tracheal Tube 279

FIG. PAGE
98. Hard-rubber Tracheal Tube 280
99. Tracheal Dilator 281
100. The Author's Medium Laryngeal Applicator 288
101. The Author's Long Laryngeal Applicator 289
102. Tobold's Set of Six Forceps, Knives, etc 314
103. The Author's Long Antero-posterior Laryngeal Forceps with Biting Edges 315
104. Laryngeal Papillomata 316
105. Laryngeal Papillomata 317
106. Laryngeal Papillomata 317
107. The Author's Long Lateral Laryngeal Forceps with Biting Edges 319
108. The Author's Laryngeal Cautery Electrode 321
109. The Author's Light-reflector and Screen 338
110. Spring-band Mirror-holder 339
111. The Author's Adjustable Bracket 340
112. The Author's Ear-specula 341
113. Gruber's Ear-specula 341
114. The Author's Massage Otoscope 342
115. The Author's Cotton-carrier 343
116. Normal Drumhead of Right Ear 344
117. Normal Drumhead of Left Ear 344
118. Outer Surface of the Left Tympanic Membrane of an Adult 345
119. The Author's Automatic Tuning-fork 347
120. Hartmann's Tuning-forks 348
121. Galton's Whistle 350
122. Politzer's Acoumeter 351
123. The Author's Original Compressed-air Meter 357
124. The Author's Cut-off 358
125. Vaporizers and Combined Air-reservoir and Hand-pump 364
126. Compound Hydraulic Pump beneath the Water-basin 365
127. Single-acting Hydraulic Pump 366
128. Rotary Air-pump 367
129. Globe Double-cylinder Air-pump 368
130. Air-meter of Improved Pattern 369
131. Globe Compressed-air Apparatus 370
132. Buttle's Inflator 370
133. Politzer's Airbag 371
134. The Author's Improved Inflator 371
135. Eustachian Catheter 372
136. Vertical Section of the Naso-pharynx with the Catheter Introduced into the Eustachian Tube 372
137. Fixation of the Catheter with the Left Hand 373
138. Toynbee's Auscultation-tube 373
139. Gangrene of the Ear; Mastoid Operation 377
140. Hypertrophied Auricle 381
141. Lever and Handle 384
142. Hard-rubber Syringe 385
143. Alpha Syringe 386
144. Author's Small Powder-blower for the Ear 389
145. Ear forceps 394
146. Rupture of the Antero-inferior Segment of the Drumhead Caused by a Box on the Ear 396
147. Section through the Tympanic Membrane, Malleus, and Upper and Outer Tympanic Wall of a Decalcified Preparation 397
148. Eustachian Tube and Tympanic Cavity 399
149. Radiate Vascular Injection of the Drumhead 403
150. Radiate Vascular Appearance in Acute Inflammation of the Middle Ear 404
151. Convexity of the Drumhead Due to Pressure from Within 407

FIG. PAGE
152. Nipple-shaped Bulging of the Posterior Portion of the Drumhead, on the Summit of which is the Perforation 410
153. Fluid Effusion in the Tympanic Cavity, Marked by a Bright Line 411
154. Circumscribed Bulging of the Drumhead, Due to Pressure of Fluid in the Middle Ear 412
155. Great Concavity of the Drumhead and Foreshortening of the Hammer-handle 413
156. Semilunar Chalky Deposit in Front of the Handle of the Mallet 419
157. Niche of the Fenestra Ovalis, with the Crura of the Stapes, in the Normal Ear of an Adult 420
158. Marked Retraction of the Drumhead 424
159. Circumscribed Depressions in the Antero-inferior Quadrant of the Left Drumhead 425
160. Circumscribed Adhesion of the Membrana Tympani to the Promontory Underneath the Handle of the Mallet 426
161. The Intratympanic Masseur 427
162. Lucæ's Pressure-probe 428
163. The Author's Ossicle-vibrator 433
164. Section of the Posterior Fold of the Membrana Tympani 434
165. Internal Surface of the Left Membrana Tympani 435
166. Triangular Resection of the Drumhead 436
167. Middle-ear Instruments and Handle 440
168. The Author's Ossicle-hook 440
169. Politzer's Pincette 441
170. Vertical Section of the External Meatus, Membrana Tympani, and Tympanic Cavity 442
171. Extensive Destruction of the Drumhead 445
172. Pear-shaped Perforation of the Drumhead 446
173. Perforation of the Posterior Half of the Right Drumhead 446
174. Destruction of the Inferior Half of the Membrana Tympani, laying Bare the Promontory and Niche of the Round Window 447
175. Large Perforation of the Right Drumhead 447
176. Destruction of Inferior Half of the Drumhead 449
177. Slender Middle-ear Probe 450
178. The Author's Large Powder-blower for Use with a Hand-bulb or Compressed Air 451
179. The Author's Ear-aspirator 454
180. Politzer's Polypus-forceps 457
181. The Author's Middle-ear Case 458
182. The Author's Caustic Applicator on Flexible Shank 458
183. Vertical Section of Middle Ear; Drumhead in Contact with the Inner Wall 459
184. Band-like Cords between the Lower End of the Hammer-handle and the Stapedo-incudal Articulation 460
185. Central Perforation of the Drumhead and Calcareous Deposits 461
186. Facial Paresis 464
187. Same as Fig. 186, Three Months after Stacke Operation and Treatment with Electricity 465
188. The Author's Ear-electrodes, Attached to a Head-band 466
189. Sequestra of Dead Bone, and the Ossicles. Actual Size 468
190. Post-mortem Section of the Temporal Bone, showing a Perforation of the Lateral (Sigmoid) Sinus 469
191. The Author's Middle-ear Curette 470
192. Horizontal Section of the Ear 470
193. Interior of Base of Skull 480
194. The Author's Icebag 483
195. Buck's Mastoid Knife 485
196. The Nevius Electric Head-lamp 486
197. A Strong Scalpel 485

FIG. PAGE
198. The Author's Mastoid Chisel. Actual Width 487
199. The Author's Long Mastoid Gouges. Actual Width 487
200. Lead-filled Mallet 488
201. The Author's Set of Curettes 488
202. The Author's Mastoid Guide 489
203. Mathieu's Tongue-holding Forceps 489
204. The Author's Periosteum Elevator 490
205. The Author's Self-retaining Retractors 490
206. A Mastoid Operation 493
207. Operating-room and Accessories 494
208. Horizontal Section through Right Temporal Bone, cut Two Millimetres above the Centre of the External Canal 495
209. Side-view of a Skull, showing Opening in Mastoid Process for Schwartze Operation 496
210. Schwartze Operation 497
211. Opening of the Antrum 498
212. Horizontal Section through Right Temporal Bone, showing Distance between Lateral Sinus and External Canal 499
213. Horizontal Section through Right Temporal Bone, cut near Centre of External Meatus, showing how Close the Lateral Sinus may Come to the External Canal in some Cases 499
214. Perpendicular Section through the Right Temporal Bone 500
215. Adhesive-plaster Dressing for Mastoid Wound 501
216. Line of Incision Healed Two Months after Schwartze Operation ... 501
217. The Radical Tympano-mastoid (Stacke) Operation, Completed 502
218. Side of Skull, showing Stacke Operation 503
219. Vertical Section through the Ear 504
220. Section of the Temporal Bone. Actual Size .... Facing 504
221. Section of the Temporal Bone. Natural Size .... Facing 504
222. Horizontal Section of Temporal Bone, cut near Floor of External Meatus 505
223. Six Weeks after Stacke Operation 506
224. Appearance Two Weeks after the Modified Operation 507
225. Post-mortem Section of Mastoid Process 508
226. Appearance Three Weeks after a Modified Stacke and an Operation for a Neck-abscess 509
227. Abscess of the Mastoid Process Extending over Ten Weeks, Resulting in an Enormous Abscess of the Neck, Reaching Nearly to the Thoracic Cavity 510
228. The same as Fig. 227, showing the Outline of the Swelling 511
229. The Conical Conversation-tube 529
230. The London Horn 530

LIST OF COLORED PLATES.

PLATE PAGE
I. Vertical Antero-posterior Section of the Nasal Cavities, Mouth, Pharynx, and Larynx .... Facing 6
II. Various Diseases of the Nasal Cavities .... Facing 24
III. Various Diseases of the Nasal Cavities, Palate, Uvula, and Tonsils .... Facing 56
IV. Diseases of the Nose and Pharynx and Anatomy of the Nose, Pharynx, and Larynx .... Facing 147
V. Anatomy of the Larynx .... Facing 251
VI. Various Diseases of the Larynx .... Facing 282
VII. Various Diseases of the Larynx .... Facing 312
VIII. Various Diseases of the Ear .... Facing 396

PART I.

Diseases of the Nose.

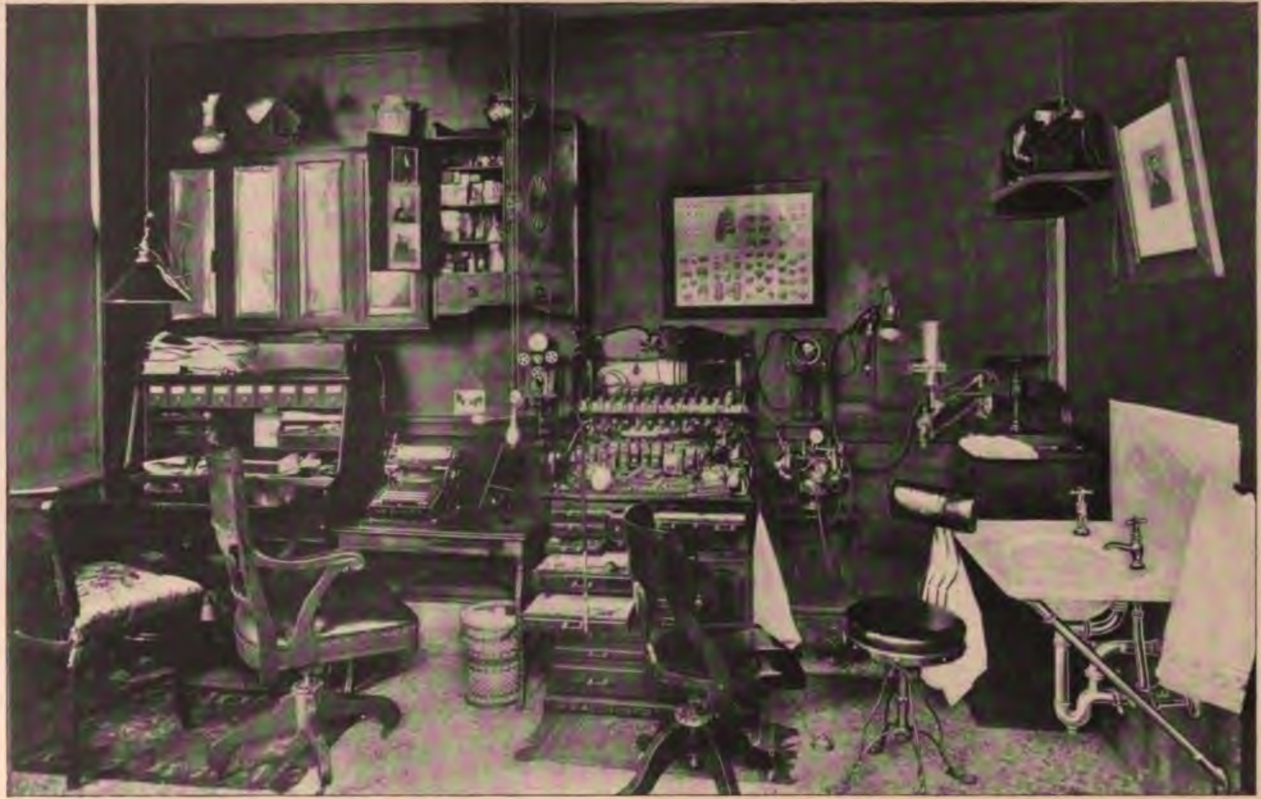


Fig. 1.—Convenient Arrangement for Treatment Room.

CHAPTER I.

DISEASES OF THE NOSE.

Examination and Instruments.

Rhinological practice requires an illuminating apparatus like the one shown in Fig. 111, or the electric forehead-lamp, or a student-lamp. Fig. 2 shows an electric light attachable to a portable battery. It consists of a telescoping cylinder from one and one-half to two inches (four to five centimetres) long, and is five-eighths of an inch (sixteen millimetres) in diameter, provided with two powerful lenses. This instrument, when lighted, throws a white light of six- to eight- candle power directly upon the object in the focus. This illuminator is particularly adapted to the wants of the specialist. By removing it from the head-band it may be used as a hand-illuminator in examining other cavities of the body. The examiner should sit sidewise by the patient, immediately in front and facing him, using the three-inch forehead-mirror, which is shown in Fig. 110. Reflected

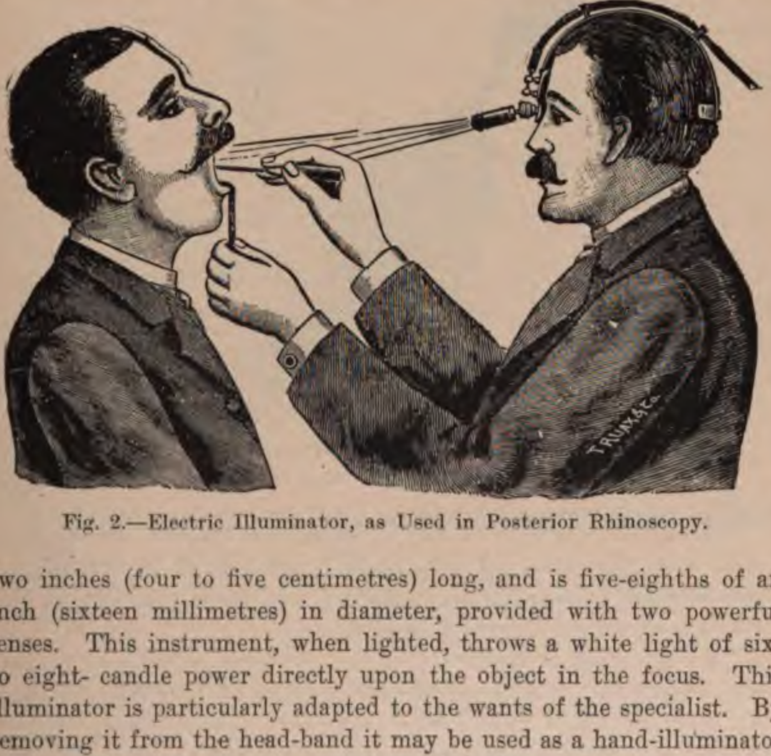


Fig. 2.—Electric Illuminator, as Used in Posterior Rhinoscopy.

light only can be used to advantage in this practice. The surgeon should wear the mirror in front of his eye so as to look through the perforation in the glass, and in such a manner as to shade both eyes from the light. The room is best darkened in order to avoid the contracting effect of the light on the pupils of the surgeon's eyes.

A convenient arrangement of a treatment-room is illustrated in Fig. 1. It shows, in a compact space, an adjustable gas-lamp, fitted with a light-reflector; electric lamps; compressed-air regulators, with two treatment tubes and cut-offs attached; nebulizers and sprays; a dynamomotor, which transforms the electric current for cautery purposes and operates the dental arm for trephines, drills, etc.; and the Pynchon cabinet for instruments, medicines, linen, etc.

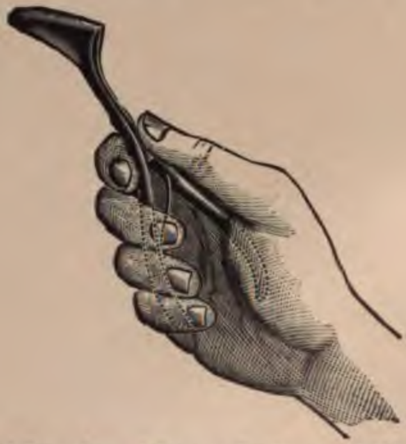


Fig. 3.—Nasal Speculum of Correct Pattern, and the Proper Way to Handle it.

During the examination of the nose, one hand of the operator should rest on the top of the patient's head so as to control and manipulate its movements as is necessary in order to bring all the parts to be examined into the field of vision.

The instruments required for anterior rhinoscopy are a nasal speculum (Fig. 3), a long cotton-carrier (Fig. 115) to remove secretions that obstruct a view of the parts, and a bent long probe for searching out hyperæsthetic areas and determining the contour and extent of anomalies.

The nasal speculum is best held in the palm of the hand with the back of the fingers directed toward the patient's chin. The handle of the speculum should project straight outward and downward from the bivalves, so as to leave sufficient room between the patient's chin and the surgeon's fingers. The valves should be small enough at their tip to use with children. In manipulating the speculum the pressure ought to be exerted mainly on the soft, yielding ala of the nose, and not on the septum. De Vilbiss has devised an excellent self-retaining nostril-dilator to be held in place by a rubber band about the head.

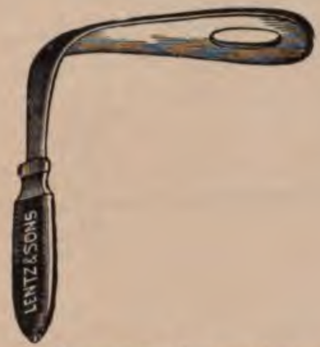


Fig. 4.—Bosworth's Tongue-depressor.

Anterior rhinoscopy, or the examination of the anterior nares, reveals the anterior extremities of the turbinated bodies and the side of the septum. The patient's head is tilted backward or forward, as the upper or lower parts of the nasal cavities are to be inspected. In many instances we can obtain a clear view entirely through the nose to the vault and posterior wall of the pharynx. In others, hypertrophies of the turbinated bodies or of the septum or deflections of the latter occlude the view.

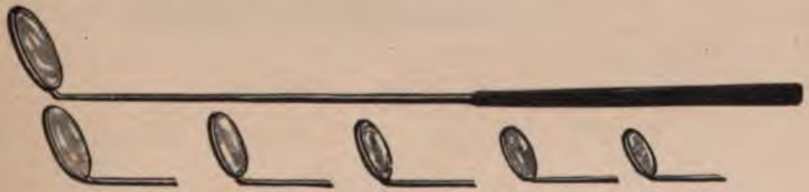


Fig. 5.—Throat-mirrors.

In health the color of the mucous membrane covering the lower portions of the fossa is a light pink; that of the superior turbinated body and roof of the nasal arch is yellowish. The nature of the light furnishing the illumination may vary the shade considerably.

Posterior rhinoscopy calls for the use of a tongue-depressor (Fig. 4), rhinoscopic mirrors (Fig. 5), and occasionally a palate-retractor (Fig. 6). The tongue-depressor should not be inserted far enough to cause retching, and the patient is told not to resist the gentle pressure and not to gag. His co-operation aids materially in the examination, and only a little practice is necessary to success. When the rhinoscopic mirror is introduced, the tongue-depressor is held by the left hand and the mirror by the right. Just before introducing the mirror it is warmed by passing it with the glass side downward over the lamp for an instant only, to avoid the condensation of the patient's breath on it, which would prevent a reflection of the post-nasal image. If the mirror is too greatly heated its backing is destroyed. Another method, which the author has employed satisfactorily for a considerable time, is to cover the glass surface of the mirror with liquid soap, and then polish it with a dry cloth. This soft soap prevents the breath from condensing on the glass, and renders the use of heat unnecessary. I have used Lee's liquid soap for this purpose.

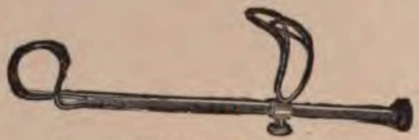


Fig. 6.—White's Palate-holder.

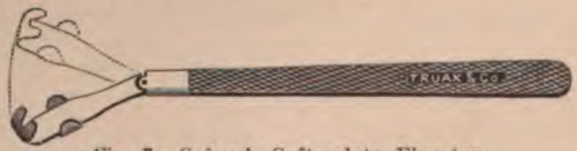


Fig. 7.—Sajous's Soft-palate Elevator.

With the light reflected into the throat by the forehead-mirror, the nasal mirror is carried over the depressed tongue until it nearly, but not quite, touches the posterior pharyngeal wall with the mirror-surface directed upward and forward (Fig. 8). The natural inclination is to breathe through the mouth when it is open, and the patient is directed to breathe through his nose so that the soft palate will fall forward and downward from contact with the post-pharyngeal wall. Then, with the light properly directed upon the mirror, an

PLATE I.

PLATE I.

Vertical antero-posterior section of the nasal cavities, mouth, pharynx, and larynx.

1. Frontal sinuses.
2. Superior turbinated body.
3. Sphenoid sinuses.
4. Middle turbinated body with posterior hypertrophy.
5. Adenoid growths.
6. Inferior turbinated body.
7. Orifice of the Eustachian tube.
8. Fossa of Rosenmüller.
9. Oral tonsil.
10. Epiglottis.
11. Vocal cord.
12. Trachea.

The mirror and line of reflected light illustrate laryngoscopy.

PLATE I.

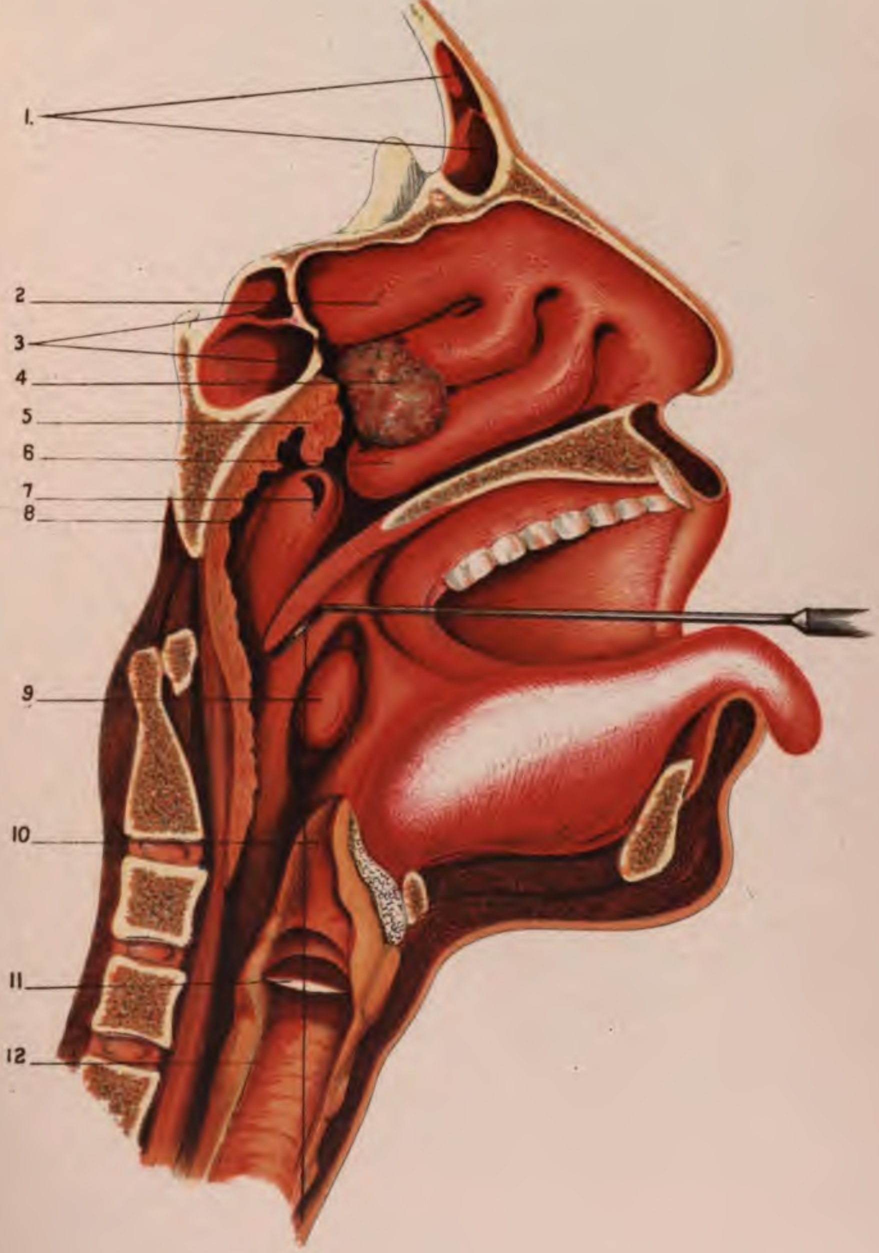


image of the posterior nares should be seen. If the palate still embarrasses the view, it can be lifted and drawn slightly forward by the palate-elevator (Figs. 6 and 7). Painting the uvula and velum with a 4-per-cent. solution of cocaine or eucaine will facilitate this procedure. The Sajous elevator is convenient. It is placed so as to lift the uvula with the soft palate, and the handle is held a little to one side, so as not to obstruct the field of vision.

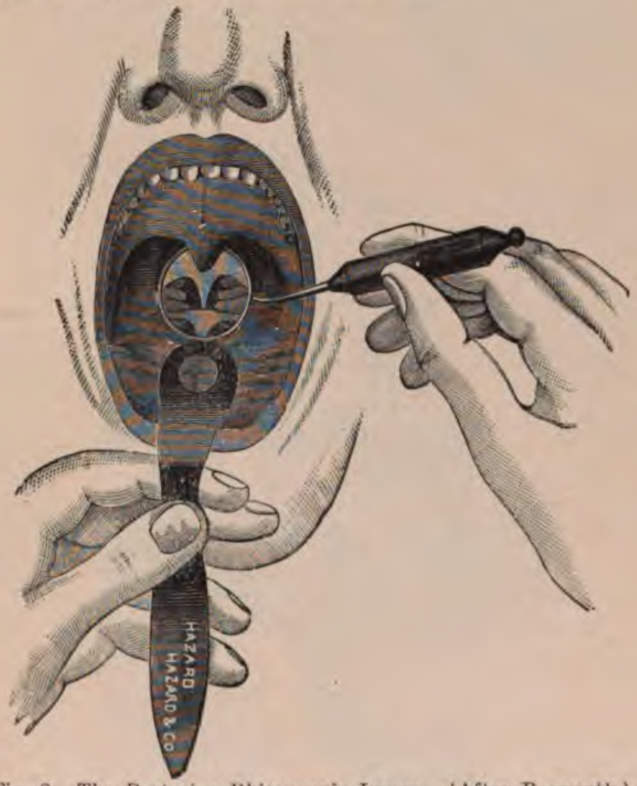


Fig. 8.—The Posterior Rhinoscopic Image. (After Bosworth.)

As large a mirror should be used as the space will permit (one-half to three-fourths of an inch—thirteen to nineteen millimetres), but it must be small enough not to necessarily come in contact with the surrounding parts and produce gagging. The mirror is so manipulated as to bring the plane of its surface at an angle of about sixty degrees to the perpendicular plane of the posterior nares, in order to obtain a perfect image.

The first reflected image to attract the attention is that of the velum palati. By slightly changing the position of the mirror, the septum on the one side and the orifice of the Eustachian tube on the other come prominently into view, with the posterior ends of the turbinate bodies in the centre of the field. The two lower ones, of a light-pink hue, are easily distinguished; but the superior body, yellowish and dimly outlined in its remote recess, is not so easily seen.

The vault of the pharynx is rendered visible by tilting upward the mirror-handle in varying degrees until one obtains an image of the pharyngeal tonsil. It is often necessary to cleanse the nasal passages with the detergent solutions before a complete inspection can be made.

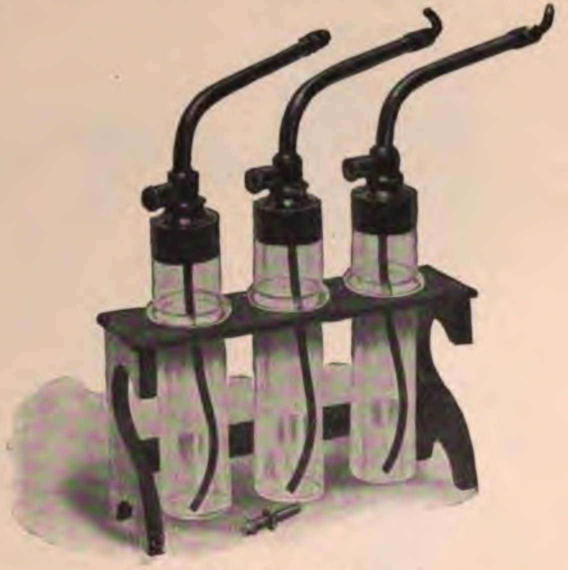


Fig. 9.—The Davidson Spray-producers.

The Davidson atomizers (Fig. 9) are very convenient for cleansing and medicating the nares. They throw a very coarse spray, bathing the parts profusely. They hold a large amount of fluid, do not leak, and are supplied with both straight and curved tips for the naso-pharynx and larynx. The De Vilbiss atomizer (Fig. 10) has an excellent adjustable tip. It can be turned so as to throw the spray in any direction desired, from the posterior nares to the larynx. His latest device to be used with compressed air has a flange upon which the fingers rest to prevent the column of air from throwing the instrument out of the grasp. It is made with a broad base so as to prevent it from tipping over, and it can be used with the hand-bulb also. The lavolin atomizers (Figs. 11 and 12) are very convenient for home treatment. We often prescribe these with a 3-per-cent. solution of camphor-menthol in lavolin or benzoinol for patients to use at bedtime, to aid in the treatment. By this means they keep the upper respiratory passages cleansed and protected and they are more faithful to the treatment. The results are more satisfactory with this method.

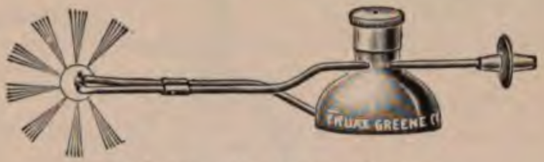


Fig. 10.—The De Vilbiss Atomizer.

My assistant, A. H. Andrews, has devised an excellent atomizer which will produce both coarse sprays and fine vapors, and it can be operated by a rubber bulb or by the compressed-air apparatus (Fig. 13).

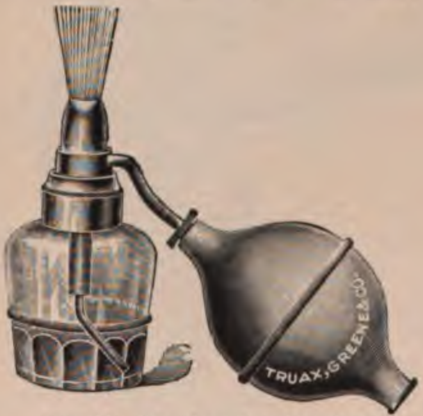

TRUAX, GREENE & CO.

Fig. 11.—The Lavolin Atomizer.

Many devices are employed for treating the nasal cavities, but few are necessary. Some are capable of doing actual harm. The Weber nasal douche has thrown watery solutions through the Eustachian tubes into the middle ears, setting up an inflammation. This is especially liable to happen when any stream of fluid is passed into the nostril, for there is a strong inclination to swallow, provoked by the presence of the liquid. In the act of deglutition the orifices of the tubes open and allow the entrance of the fluid into the tympanic cavities. One of the most useful instruments for medicating the respiratory passages, after they are properly cleansed, is shown in Fig. 14. It consists of a nebulizer which projects the most finely diffused spray obtainable, and admits of the use of much stronger medicaments than are ordinarily used. It is so constructed that the medicament from one of the nebulizing globes can be propelled into the nose, throat, or middle ear in a steady current, or with interrupted currents by tapping on Valve I. Or the inhalents in

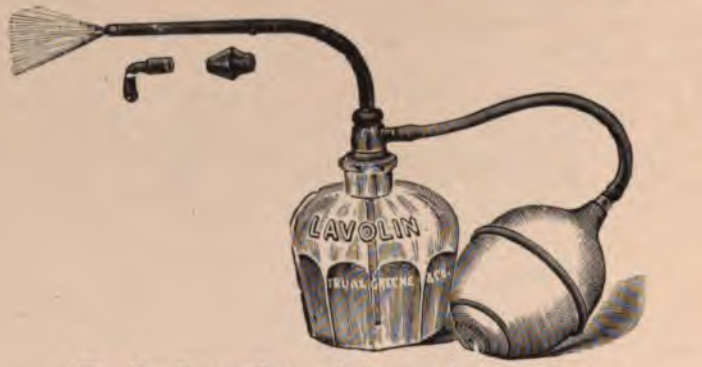


Fig. 12.—Truax, Greene & Company's Atomizer.

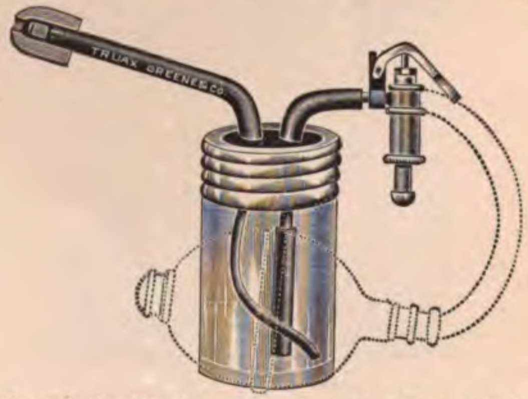

TRUAX GREENE & CO.

Fig. 13.—Andrews's Combined Atomizer and Vaporizer. With the nasal tip lightly adjusted a fine vapor is produced; with the tip firmly pressed upon the spray-tube, a coarse spray results.

two or all of the nebulizing globes can be combined and used at the same instant.

An important addition to this vaporizer is the air-regulating collar below Push-button I. By this device the amount of pressure is easily controlled and shut off altogether, if desired, when the interrupted current is employed for inflating the middle ears.

The compressed air is supplied to Circular Tube H by means of attaching the cut-off of the air-reservoir to it. The air is admitted to the globes by opening the keys at *G*.

For those practitioners who are not supplied with a compressed-air apparatus the Globe nebulizer (Fig. 15) is an excellent substitute for the large vaporizer. It is also fitted for use with compressed air and is employed in the same manner as the vaporizer. Fig. 16 represents an inhalation taken through the aseptible face-mask. Fig. 17 shows the inhalation through a small vulcanite mouth-tube, and in Fig. 18 the returning medicated vapor is seen to issue from both nostrils. Figs. 19 and 20 illustrate the medication of the nasal passages and vault of the pharynx by permitting the vapor to enter one nostril and return through the other or through the mouth. In Fig. 21 the opposite naris is closed while the vapor is made to inflate the middle ears.

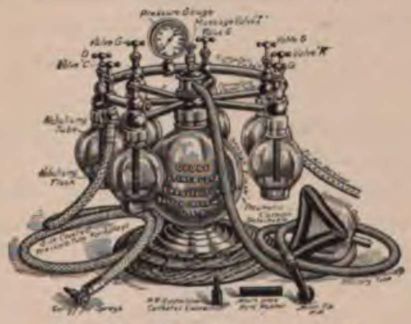


Fig. 14.—The Globe Vaporizer.

With such perfect instruments as are here shown, and with sufficient air-pressure, the most effective treatment is rendered possible with accuracy and ease. Homer M. Thomas has demonstrated by experiments in Cook County Hospital that a vaporized medicament penetrates into the pulmonary alveoli of the human lung. He writes: "I have repeatedly seen good results in the treatment of localized inflammations of the bronchial tract, by inhalation, as far as the second division of the bronchi. I have obtained results in that way that I have repeatedly failed to secure with internal medication. It is surprising how the respiratory ability can be increased by a little instruction and effort." *(The Laryngoscope,* November, 1897.)

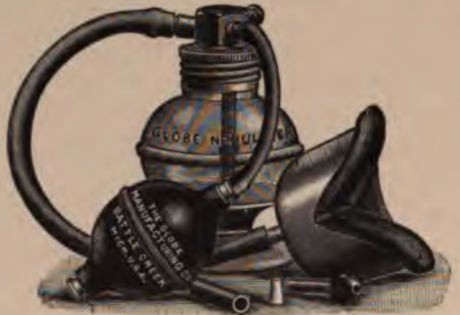


Fig. 15.—The Globe Nebulizer.

SPRAYS AND INHALENTS.

I have devoted considerable time to the investigation of inhalents, and have endeavored to arrive at definite results. We know well the action of nitrate of silver or sulphate of zinc when applied to mucous membranes, but accurate studies have not been sufficiently devoted to the physiological actions of the large number of inhalents offered for our use.

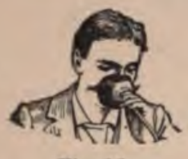


Fig. 16.

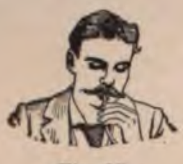


Fig. 17.

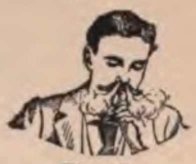


Fig. 18.

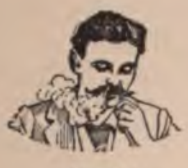


Fig. 19.

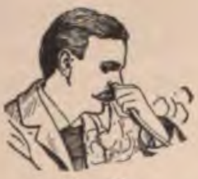


Fig. 20.

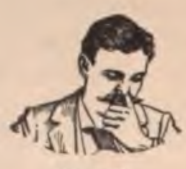


Fig. 21.

These actions should be determined before we apply a local remedy to a diseased surface, for the same reasons that no internal medicine should be administered without fulfilling a special indication for its use.

In the case of camphor-menthol we have no doubt as to its place in therapeutics. We have defined its actions: It contracts the capillary blood-vessels of the mucous membrane, reduces the swelling; relieves pain and fullness of the head, or stenosis; arrests sneezing, checks excessive discharges, and corrects perverted secretions. We know, also, that it possesses antiseptic qualities.

Since my introduction of this remedy at the meeting of the Mississippi Valley Medical Association, in 1891, it has come into quite general use for catarrhal conditions of the upper respiratory tract.

Although the author did not recommend it until long after he had discovered that the union of these two camphors resulted in a fluid of the chemical formula $C_{10}H_{18}O$, and after becoming satisfied that we possessed a valuable remedy in this new drug, he is now able to express greater confidence, and to verify former statements by the experience of others as well as by the daily use of it up to the present time. The experimental stage has passed and the efficacy of this remedy is clearly established. Specialists who were at first skeptical as to its virtue have since adopted it as a standard remedy in both private and dispensary practice. I have taken pains to ascertain the results of their experiences, and add them to my own.

Pure camphor-menthol is the product resulting from bringing together equal parts of gum-camphor and menthol crystals without heat. They soon form a colorless liquid by uniting in nearly equal parts. This pure camphor-menthol is used in combination with lavolin or benzoinol in various strengths for producing sprays and vapors. Lavolin is a purified, colorless, petroleum-oil. Benzoinol is a similar oil, with the addition of benzoin.

The field of application in which camphor-menthol has proved most efficacious is in the following diseases: Coryza, hay fever, intumescent rhinitis (intermittent and alternating nasal stenosis), hypertrophic rhinitis, simple sore throat, acute laryngitis, tracheitis, bronchitis, and after nasal cauterization.

For home use and ordinary office treatment we do not employ a stronger solution than the 3 per cent. in lavolin or benzoinol, and for very sensitive cases, like hay-fever sufferers, the 1- or 2-per-cent. solution at first. The lavolin is a bland and soothing protective to the membrane, and in the combinations indicated we have a most effective and harmless remedy. This means a great deal to both patient and physician, for many of the sprays in use give indifferent results—or worse.

Patients should be instructed to treat themselves thoroughly every night on retiring, by throwing a spray of the 3-per-cent. solution from an atomizer (Fig. 11) into both nostrils while slowly inhaling. The rubber bulb should be forcibly and rapidly compressed at least eight times for each nostril. For the throat, larynx, or bronchial tubes the spray should be thrown through the mouth during inhalation.

In diphtheria, croup, etc., in infants, when it is very difficult to throw a spray into the throat, the medicine may be made to reach the parts in a volatile form by placing a few drops of the pure, undiluted camphor-menthol in a hot-water inhaler (Fig. 22) or a tea-kettle of hot water and causing the patient to breathe the medicated steam; or a few drops can be heated in a spoon over a lamp, and its fumes will impregnate all the atmosphere of the room. Enough medicine need not be used to cause uncomfortable smarting of the eyes. Inflammation of the throat, larynx, trachea, and bronchi can be effectually treated by inhaling the camphor-menthol steam in this manner.

The writer has found that we can prevent hæmorrhage and inflammation, following galvano-cauterization of the turbinated bodies, by gently packing a pledget of cotton wet with a 10-per-cent. solution of the camphor-menthol between the burned tissue and the septum and leaving it there twenty-four or forty-eight hours. It is then replaced by a fresh dressing, and, at the end of four or five days, instead of finding sloughs filling the passages, swelling, and stenosis, the tissues appear shrunken and mummified and the strait is clear. Unless the electrode has been allowed to cool before removing, no hæmorrhage or only slight oozing occurs. There is also less discomfort following this method than after others. The cotton should not be saturated to the dripping point with the solution so as to allow it to trickle down into the throat, and if too much is used it occasions a copious serous secretion. Advantage of this power of the strong solution to cause stimulation of the glands and osmosis can be taken in treating ozæna and dry catarrh of the nose and throat. The weak solutions diminish secretions; the strong ones increase them.

For self-treatment of the nose and throat patients have found much relief by using an inhaler like that shown in Fig. 23, which can be carried in the pocket, and contains a liquified mixture of equal parts, by weight, of camphor and menthol. It has a more soothing and correcting effect on the nerves and vessels than menthol alone. It does not become irritating, like menthol-crystals, after being used for some time. It can be used unnoticed in public places the instant any irritation appears, and thus prevent or cut short attacks. Three or four slow, deep inhalations should be taken from it in one nostril while the other is closed, or until the irritation is relieved. The breath should not pass through the inhaler, but out through the mouth instead. To treat the throat it should be inhaled through the mouth.

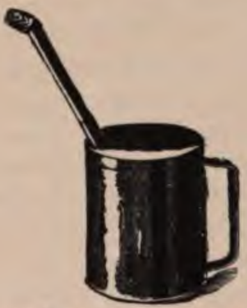


Fig. 22.—Hot-water Inhaler.

If we want a drying, detergent, and protective spray, the pine-needle oil in a 2-per-cent. solution will accomplish the purpose, and it is a most agreeable preparation. In those rare cases in which the mucous glands are atrophied and in need of a powerful stimulant to excite them to action, the 4- or 10-per-cent. cubeb-spray is the most effective, especially when combined with the 10-per-cent. strength of camphor-menthol and benzoinol.

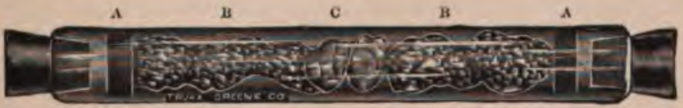


Fig. 23.—The Author's Camphor-menthol Inhaler.

There is a prevalent mistaken opinion that the cubeb-spray is drying to the mucous membrane, while the opposite effect is the true one. It is a stimulant and disinfectant. It increases the flow of mucus, and if used in too strong a preparation it acts as an irritant. Cubeb is useful as a tonic in chronic irritability of the pharynx and larynx, especially in the hoarseness of public speakers and singers.

Eucalyptol is antiseptic, and destructive to low forms of life. It is a stimulating expectorant, and must not be used in very strong solutions, or it becomes an irritant. When combined with benzoinol in the proportion of 20 grains to the ounce it is not too strong for the majority of patients, but, as a rule, it must be avoided in hay-fever patients. Some of them cannot remain in the room where it is being sprayed without suffering from paroxysms of sneezing. Carbolic acid combined with benzoinol, 2 grains to the ounce, is valuable when the antiseptic and anæsthetic effects are required. It is very useful in ozæna, especially when followed with aristol.

Antiseptic aqueous solutions are necessary for properly washing out and cleansing the nasal cavities preparatory to the application of other medicaments. Dobell's solution is the most universally used. It consists of biborate and bicarbonate of sodium, of each, 1 drachm; carbolic-acid crystals, 12 grains; glycerin, 2 drachms; water, enough to make 8 ounces. Seiler's antiseptic solution is also satisfactory, and is easily and quickly made by dissolving one of his tablets in 2 ounces of pure water. These solutions dissolve, loosen, and wash out the secretions and crusts, so that the diseased membrane itself can be reached. Many other formulæ will be found in the appendix.

CHAPTER II.

DISEASES OF THE NASAL CAVITIES.

INFLUENZA.

THERE are two types of this disease. One is an uncomplicated catarrhal condition of the respiratory tract prevailing generally during the changes of the seasons from fall to winter and from winter to spring, and may appear at any time during the year. The other is of an epidemic nature and is known under several names, as follow: The grip; grippe; epidemic catarrh, or catarrhal fever; blitz catarrh; epizootic. Since the treatment of the severer variety will include that of the milder, we will consider the subject of the epidemic form.

Epidemics of influenza date back beyond the Christian era, and as early as the year 415 B.C. the Athenian army in Sicily was afflicted with this trouble. There is a periodical outbreak of a similar disease, occurring twice a year, in January and August, in the Caroline Islands, from which nearly all the inhabitants suffer; but this is very suggestive of hay fever. In the year 1510 the British Islands were visited by a very extensive epidemic of influenza, but up to that time no exact records of it were written. Since that period there have been more than twenty outbreaks of severe type, besides many minor ones.

The disease usually is first manifested in the far East, generally in some part of Russia, and travels rapidly from east to west. The greater the facilities for rapid transit, the faster it invades the western countries. It has traveled from near St. Petersburg to New York in six weeks. It prevails in all climates and attacks all classes of society, but infants enjoy partial immunity. While it has been made the butt of jest by the uninformed masses and the subject of ridicule by the unthinking triflers in medicine, it is more to be feared than small-pox or cholera. It cannot be quarantined and controlled by protective measures like those diseases, and when it does not kill it blights and withers and leaves its deadly sting to blot out one's sight, or hearing, or reason, or sows its morbific seeds in other organs to insure its victims future maladies. When it first appeared in Paris the effects were worse than any of the three epidemics of cholera during the thirty years preceding 1884. The influenza epidemic of 1891 in Chicago, lasting about six weeks, produced the highest mortality the city had ever known.

Pathology.—The exact nature, cause, and method of origin and propagation of this disease are not yet definitely determined. It is easier to say what it is not than to say precisely what it is. It is not a simple catarrhal affection. It is a specific, infectious, and contagious disease. The principal manifestations occur in the mucous membrane of the respiratory tract. There are congestion and swelling of this membrane in the nose, throat, and larynx, and sometimes extending as far as the bronchial tubes. In certain cases the inflammation invades the gastro-intestinal canal. F. B. Turck illustrates the importance of clearing the nose and throat of diseased conditions. He demonstrated that the micro-organisms found in diseased stomachs were the same as those found in the post-nasal cavities and mouths of the same patients.

Various bacteria have been found in the sputa of persons suffering from this disease. Staphylococci and streptococci were especially abundant, but it is still an open question as to what actually constitutes the specific infection that gives rise to the attack. Some observers believe that the true influenza bacillus has been found, while others are of the opposite opinion and suggest that the micro-organisms found may be the product instead of the cause of the disease.

Richard Pfeiffer announced in 1893 that he had discovered the specific germ of influenza, and his claim has been largely credited. Pfeiffer's organism is a short, plump bacillus, found chiefly in the purulent secretion from the respiratory tract in influenza.

It seems reasonable to assume, from the rapidity with which the whole organism shows the presence of infection, that it first enters the blood. No other theory yet advanced satisfactorily accounts for all the phenomena that it presents.

Etiology.—Epidemic influenza is believed by some to be caused by peculiar atmospheric conditions, which would account for its rapid extension over a large part of the globe and appearing in widely separated places at nearly the same time. We know that the upper strata of the atmosphere, in which volcanic dust is disseminated, will carry these particles to the remotest regions of the earth, and that dense poisonous gases evolved from subterranean sources may be extruded into the great ocean of atmosphere about us and prove detrimental to animal life.

During some invasions meteorological records have shown high barometric pressure, drought, northerly winds, cloudy sky, diminution of ozone, and low electrical charge of the air. While the prevailing winds have varied greatly in different countries during the same epidemic, extremely dry air has been a constant factor. This unusual dryness of the air and earth has led some to believe that the consequent liberating and floating of the resulting dust in the air and its inhalation and irritating effects upon the respiratory passages accounted for attacks. But a severe epidemic arose in Russia while the country was covered deeply with a carpet of snow; and, moreover, the respiratory system is not invariably involved.

It is claimed by some observers that the epidemic does not travel faster than man; that obstacles to travel, like mountain-ranges, obstruct its progress; that the most popular means of communication between people of different countries form the routes by which the disease progresses; and that it first gains foothold in large cities, where persons congregate in the greatest numbers: post-offices, factories, schools, banks, etc. All these facts point to the harboring and conveying of the germs of influenza by human beings.

Symptomatology.—The variations of the disease as it appears in different individuals, and even in the same person, are susceptible of classification under three natural divisions of the subject: as it affects (1) the nervous system, (2) the alimentary canal, and (3) the respiratory tract, including the Eustachian tube, middle ear, and pneumatic cells of the mastoid process. We are especially concerned with the latter form.

It is not common to see all of these forms affect the same patient at the same time, but it is not uncommon to see two of them co-exist. For example: The great mental depression with extreme prostration of the muscular system that first makes its appearance may be quickly followed by the gastric and intestinal disturbances that add to the exhausted condition already present. We often see the nervous and respiratory forms combined, but not the simultaneous invasion of the air-passages and alimentary canal.

Two of the three forms are sometimes consecutive to each other. To illustrate: One of our younger professors in the Post-graduate Medical School was attacked during the epidemic with vomiting and purging and general prostration, from which he nearly recovered in five days, when he was seized with sneezing, running at the nose, sore throat, hoarseness, and mild bronchitis.

Chilliness and heat may often be marked when the temperature rises only one or two degrees, but the rise is often to 103° or 104° F. In addition to a sudden sense of great fatigue there often occur shooting pains in the head, pain and muscular soreness in the extremities or abdomen, aching of the back and loins, and in the respiratory form coryza, pharyngitis, and often an invasion of the lower air-tract.

We have observed that patients with an unusual form of middle-ear disease begin to present themselves in both private and dispensary practice about one week after we become conscious of the presence of an epidemic of influenza. They often present this story: "Doctor, I was taken a few days ago with a cold in the head, and I had a great pain in my ear last night. It broke during the night and ran blood and water." They present a picture of acute suffering, anxiety of countenance, weakness of the limbs; coated, indented, and tremulous tongue; and complain of pain radiating over the corresponding side of the head. The mastoid is more often involved than in the simple middle-ear inflammation complicating influenza between epidemics. The external-ear canal is found to contain bloody serum; the drum-head is red, swollen, and bulging; and the tympanum is filled with discharge. The hearing is usually much impaired.

Diagnosis.—As soon as the catarrhal symptoms of the respiratory tract make their appearance, the diagnosis is a simple matter. The symptoms already enumerated are sufficient to decide the question, and the presence of an epidemic will suggest the nature of the complaint.

Prognosis.—Robust individuals are able to resist the attacks sufficiently to recover in a few days or weeks, but persons already debilitated or suffering from diseases of vital organs are prone to succumb either during the attacks or as a sequel to them.

While the general statement may be made that a small percentage of cases die during the attacks, this does not convey any adequate idea of the actual damage done by an epidemic, because, in the first place, such vast numbers of the population fall victims to its ravages, and, in the second place, many die, or are made defective, as its sequel.

Treatment.—The patient is put to bed and the bowels relaxed if necessary. When the temperature is high it is reduced with antipyrin or one of its efficient substitutes, and the pain and other distressing symptoms are relieved by the coryza tablets containing a combination of morphia, atropia, and caffeine in the proportion of $^1/_{12}$ grain of morphia with $^1/_{600}$ grain of atropia and $^1/_6$ grain of caffeine. The morphia relieves the pain and nervous irritability, suppresses the excessive secretions, and stimulates the circulation; the atropia elevates the tone of the blood-vessels, quickens the pulse, decreases all the secretions except the urine, stimulates the respiratory centre, and counteracts the constipating effect of the morphia; and the caffeine stimulates the nervous centres and the kidneys and diminishes the tendency of the morphia to produce nausea. The sneezing and nasal discharge cease, the nostrils open up, and the pain disappears.

We treat the nose and throat with a 3-per-cent. solution of camphor-menthol in lavolin or benzoinol with the atomizer three or four times a day.

This treatment, with repetition of the doses as the symptoms demand, minimizes the suffering, diminishes the intensity of the disease, and shortens its course. For rheumatic symptoms salicin or salicylate of sodium should be given. Complicating diseases call for their appropriate treatment on general principles.

Acute Rhinitis.

Synonyms.—Cold in the head; coryza; acute nasal catarrh.

Pathology.—Simple acute rhinitis is an acute inflammation of the mucous membrane of the nasal cavities. The first stage is characterized by an engorgement of the blood-vessels, not only of the mucous membrane, but of the turbinated bodies also. The membrane is abnormally red, dry, and swelled. The turgescence of the vessels remains during the second stage of the inflammation; but the membrane becomes bathed in mucus and a copious exudation of serum, the strong saline character of which irritates the nostrils and the cutaneous surfaces bordering them. Numerous white blood-corpuscles escape from the vessels into the surrounding tissues; and increased cell-proliferation in the mucosa announces the third stage. Now the character of the secretions changes from a mixture of serum and mucus to a muco-purulent and finally a purulent discharge. It is more common to childhood than adult life, and the aged are rarely afflicted with it. Coryza forms one of the symptoms of the eruptive fevers, and sometimes occasions more distress than the disease it accompanies.

Etiology.—Taking cold is the commonest cause. The impression of cold on certain surfaces of the body appears to paralyze the inhibitory power of the vasomotor nerves controlling the capillary circulation of the nasal mucous membrane. The most vulnerable surfaces are the back of the neck and head and the feet. In speaking of the causes of two of the principal symptoms of rhinitis and the manner of their production, Joseph A. White says: "Such phenomena differ somewhat in different persons, as I have found by experiments made upon myself and others. If I irritate my intranasal tissues it takes some time to produce any reflex whatever, but the first to be manifested is lacrymation on the side irritated, followed by evident swelling of the corpora cavernosa and by a serous exudation; cough I cannot produce at all. On the contrary, if I sit in a warm room with my back to an open door or window, I will begin to sneeze almost before I am aware of the draught of cooler air. I have observed the same effect in others, while, in some, artificial irritation of the nose will cause sneezing immediately, and in nearly all such persons continuance of the irritation will cause cough." The climatic and meteorological causes are discussed in Chapter XXVIII. The nervous temperament predisposes to this affection. Wagner considers that rhinitic affections are in many cases due to the immigration of micro-organisms from the tonsils when they are diseased. The uric-acid diathesis predisposes one to this disease.

Symptomatology.—The earliest manifestation of cold in the head is a sensation of dryness or irritation in the nose, prompting one to snuff the air as if to dislodge some foreign substance. This gives place to itching, tickling, or stinging sensations, followed by paroxysms of sneezing, copious flow of serum and mucus from the nostrils, suffusion of the eyes, lacrymation, flushed countenance, and possibly sensations of constriction and pain over the eyes in the frontal sinuses, and headache.

The discharge, if continued long, becomes acrid and irritating to the nasal opening and upper lip, producing redness, excoriations, and cracking of the skin over which it spreads. The efforts of the patient to keep the nose and lip dry result in the removal of the epidermis to such an extent as to leave a raw-appearing surface. One of the most distressing symptoms is the nasal stenosis produced by the great swelling of the nasal membrane and turbinate bodies. This interferes with swallowing as well as breathing. Respiration takes place entirely through the mouth, and the attempt to swallow liquids results in their being forced upward into the nasal space or even into the Eustachian tubes. The sense of smell is diminished or absent and the voice indicates the seat of the trouble. It has a characteristic nasal quality, and the sounds of *m* and *n* cannot be produced. The disease may extend to the antrum of Highmore, the frontal sinuses, the ethmoid or sphenoid cells, or the Eustachian tubes and middle ears.

Diagnosis.—The group of symptoms described presents so characteristic a picture that there is no likelihood of confounding this disease with any other, but it must not be forgotten that it is a symptom of the exanthemata.

Prognosis.—If the inflammation does not extend to the accessory cavities, recovery can be expected in a few days, but may be postponed longer in severe attacks.

Treatment.—The course pursued in the treatment of influenza, varying according to the severity of the attack, can be relied upon here. Indeed, this disease can be averted by the use of the coryza tablets mentioned for influenza, containing caffeine, morphia, and atropia. By giving one of these at the onset of the attack the symptoms subside with as much certainty as can be affirmed of any medicinal specific. The effect of this remedy lasts several hours, although the dose is small, and it should be repeated in two, four, or six hours if the symptoms begin to reappear. (See page 21.)

Prescriptions for the coryza tablets should never be given to patients. I have never allowed them to know the composition of the tablet, and for this reason no patient has ever contracted a drug habit through my carelessness. It would be much better to give the little tablets gratuitously than to run any risk whatever of becoming responsible for a baneful habit.

In the uric-acid diathesis (see Chapter III) lithia should be given, and the diet should be carefully regulated (page 50). The writer has often aborted attacks by the effervescent lithia preparations given in 6- to 10-grain doses two or three times in the twenty-four hours for one or more days.

"There is a condition in which the inferior turbinated bodies are red and turgescent, which will not collapse under local applications of cocaine, but which will yield very kindly to colchicum. Gouty intoxications or irritations have been observed in the nose, pharynx, and larynx, especially by English specialists." (W. L. Ballinger.)

Spraying the nose with a 3-per-cent. solution of camphor-menthol in lavolin or benzoinol (Figs 11 and 12) affords great relief. The physiological effects and uses of this remedy are dwelt upon in Chapter I.

The camphor-menthol pocket-inhaler (Fig. 23) affords much relief in mild attacks. Its uses are given in the preceding chapter. It affords not only a very refreshing inhalent, but, if employed as soon as the first nasal irritation is felt, the symptoms may be checked.

An important preventive measure is the protection of the body from the vicissitudes of the weather. Fabrics of vegetable fibre, such as cotton and linen, should not be worn next to the skin. Animal fibre, such as woolen or silk, favors absorption and evaporation of the perspiration, keeps the temperature of the surface of the body equable, and prevents chilling. Woolen is preferable to silk, except in the hottest weather, when silk underwear affords more comfort and sufficient protection.

SIMPLE CHRONIC RHINITIS.

Synonyms.—Chronic coryza; blennorrhœa; rhinorrhœa; purulent catarrh.

Pathology.—This is a chronic inflammation of the nasal mucous membrane, generally consequent upon recurring seizures of acute coryza. The membrane is swollen and puffy and the venous sinuses are dilated and relaxed (vasoparesis). Extensive infiltration of the interstitial tissue with serum and leucocytes occurs, with a consequent hydrorrhœa and degeneration into pus-cells. The mucous glands are excited to increased activity, necessitating a frequent resort to the handkerchief to prevent dripping from the end of the nose. The membrane is easily irritated by dust, gases, and sudden changes in the weather.

Etiology.—Exposure to damp and cold and an atmosphere loaded with irritating gases or dust act as direct exciting causes. A nervous temperament and the strumous diathesis predispose to the disease. Uricacidæmia is sometimes an important predisposing cause.

Symptomatology.—The increased nasal discharge is the most prominent feature, and the end of the nose may become so irritated as to give it a red and swollen appearance. The secretions consist of mucus and serum, or pus formation takes place to such an extent as to fill the nares with a yellow discharge. Its presence provokes frequent hawking and expectoration. Sneezing is not a constant or frequent symptom as compared with acute coryza or hay fever. An

PLATE II.

PLATE II.

Figure 1.—Male, æt. 38; hypertrophy of the entire mucous membrane of the nasal cavities; relieved by means of bougies and galvanocautery.

Figure 3.—Rhinoscopic view of above (normal size).

Figure 2.—Male, æt. 30; syphilitic perforation and exostosis of septum; mercurial treatment and mitigated stick locally.

Figure 4.—Rhinoscopic view showing exostosis of septum in the above (normal size).

Figure 5.—Female, æt. 26; appearance of nasal cavity after loss of septum and turbinated bones, and enlargement of the orifice of the antrum through syphilitic necrosis. Mercurials and iodides; extraction of necrosed bones with forceps. Potassium-permanganate washes.

Figure 7.—Rhinoscopic view of above with mirror facing obliquely from left to right (normal size).

Figure 6.—Female, æt. 17; syphilitic perforation of hard and soft palate; mercurials and iodides; mitigated stick locally.

Figure 8.—View of palate through the mouth (in state of active inflammation).

Figure 9.—Female, æt. 19; mucous polypi; removed with snare; subsequent galvanic cauterizations.

Figure 11.—Anterior view of above (normal size).

Figure 10.—Female, æt. 45; large mucous polypi; removed with snare; subsequent galvanic cauterizations.

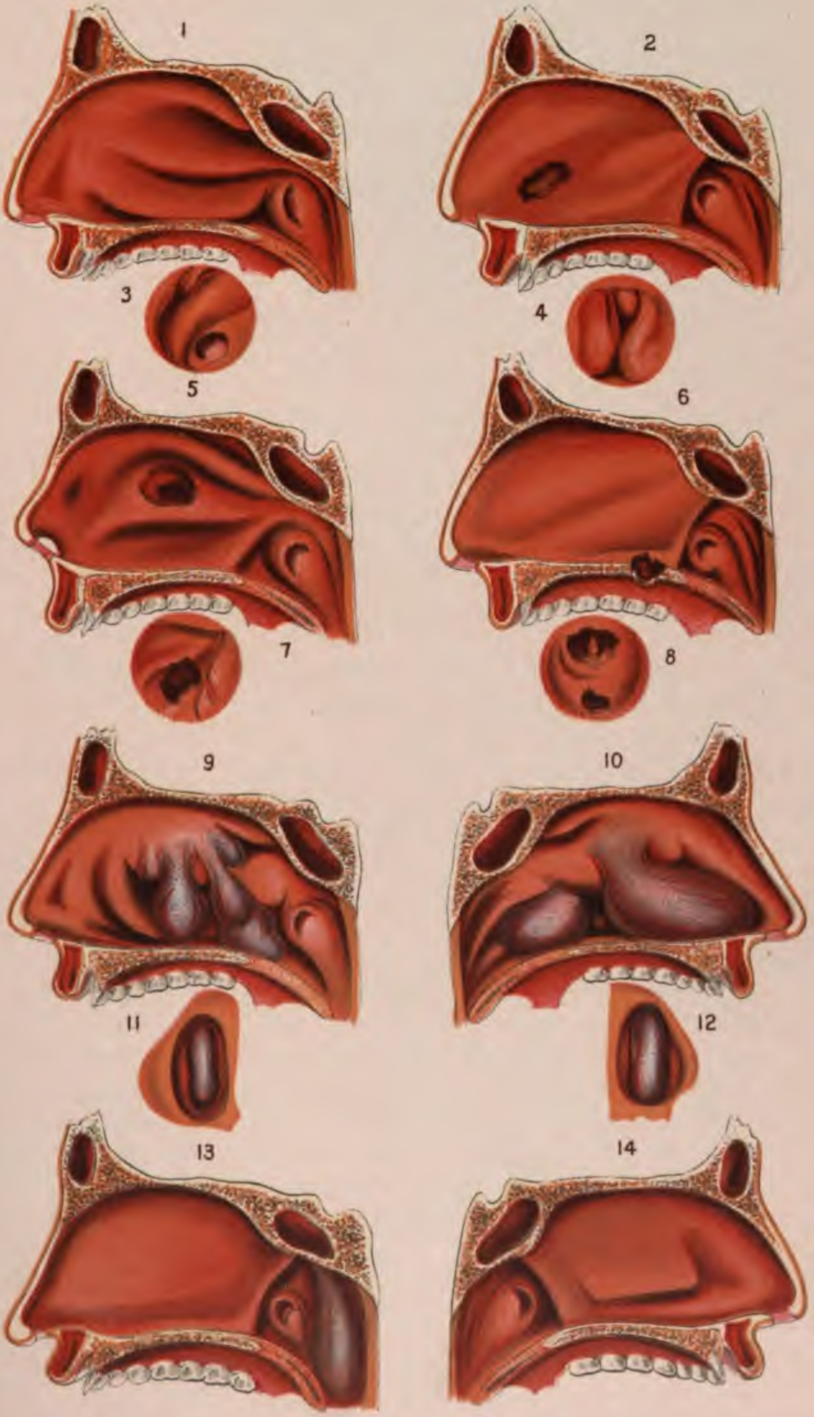
Figure 12.—Anterior view of above (normal size).

Figure 13.—Female, æt. 30; large fibrous polypus of pharyngeal vault; removed with electric snare.

Figure 14.—Male, æt. 28; central curvature and exostosis of septum; longitudinal incision with knife; oakum plugs; exostosis removed with saw.

[Note.—Represented as seen by gaslight. By daylight the red color appears much paler.]

PLATE II.



annoying sensation of fullness in the head—especially if the infundibulum, or passageway from the frontal sinus to the nose, is obstructed—may lead one to suspect involvement of the sinus.

There is a tendency for this disease to extend to the Eustachian tubes, the middle ears, or the nasal ducts, causing impairment of hearing or obstruction of the natural tear-passages. The thickening of the membrane and the turgescence of the turbinate bodies so constrict the meatuses as to impart a nasal intonation to the speech. The walls of the passages are frequently seen to be agglutinated together by a viscid, tenacious secretion, or bathed in pus. The membrane is generally redder than the normal, but in the variety in which the hydrorrhœa is abundant it may appear of a pale-pink tint or even livid.

The secretions may become dry and inspissated to the degree of crust formation. These adhering crusts excite a desire to pick at the nose until they are removed. This constant source of irritation and depriving the septum of its natural protection in the process of repair result in perforation in that part of the cartilaginous septum near the border of the nares.

Diagnosis.—To distinguish between this and hypertrophic nasal catarrh it is essential to use the probe and cocaine. When the probe is pressed upon the turbinals in simple chronic rhinitis it sinks into a body comparable to a wet sponge, for the tissues are distended with the infiltrated fluids. The depression caused by pressure fills slowly like that of a dropsical body. In the hypertrophic variety the probe meets with a firm, resisting, fibrous tissue, which possesses greater resilience. Cocaine contracts the tissues, in the simple form, until they hug the bone, leaving a wide air-space; but not so in the hypertrophic variety. In the latter the surface is uneven, in the former smooth. Suprarenal solution may be used instead of cocaine.

Prognosis.—Patients are skeptical as to the curability of nasal catarrh. It is so common an affection, especially in the region of the Great Lakes, that the inhabitants think that, as a matter of course, they must expect to suffer from it. However, with an advantageous combination of treatment and hygienic measures, a cure can confidently be predicted. But one is not warranted in promising no return of the trouble under provocative conditions.

Treatment.—The first requisite to success is cleanliness of the nasal cavities. This is best obtained by the use of sprays,—such as Dobell's, Seiler's, and other solutions,—mentioned in Chapter I.

These can be injected successfully with the hand-atomizer (Figs. 11 and 12) if one lack a large air-compressor. Eight pounds' pressure is sufficient to thoroughly wash the cavities without any likelihood of invading the Eustachian tubes.

After the membrane is thoroughly cleansed oleaginous sprays are indicated to protect the surface, stimulate the absorbents, contract the blood-vessels, disinfect, and render the mucosa less sensitive. These remedies are treated of in Chapter I. An effective treatment consists in throwing a fine nebula of a 10-per-cent. solution of camphor-menthol in lavolin, by means of the vaporizer (Fig. 13), followed by a spray of the following infusion made with lavolin: Calendula, 1 per cent.; hamamelis, 2; pinus strobus, 2; lavolin, 95. Camphor-menthol in the nebula does not bathe the membrane with the liquid, but relieves the irritability and stenosis and prepares the parts for the coarser spray which will remain in contact with the diseased surface for many hours.

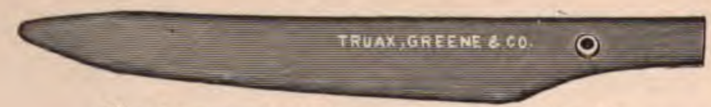


Fig. 24.—The Author's Soft-rubber Nasal Bougie.

Another excellent spray consists of: Camphor-menthol, 3 parts; pine-needle oil, 2; eucalyptol, 1; and benzoinol, 94 parts. (See Appendix.)

This treatment is best given two or three times a week by the surgeon, while the patient pursues a home treatment with a suitable atomizer and medicament in order to prolong the effect of each office treatment and render it continuous. Cocaine is not mentioned by the author as a therapeutic agent, because it is not of such a nature as to effect permanent results, and because of the imminent danger of converting one's patron into a pernicious-drug slave. Cocaine has no place in my practice except as an anæsthetic in surgical procedures.

Bougies and dilators of medicated gelatin, hard and soft rubber (Fig. 24), and metal are useful in reducing the engorgement of the turbinate bodies and overcoming contact and pressure of these bodies upon the septum. The bougies adapted in contour and size to each individual case are introduced between the turbinals and septum for a few minutes at first, beginning with the smaller, and used on the same principle as sounds and dilators in other departments of surgery.

When the engorgement of the vessels of the turbinate bodies produces great intumescence of those structures and consequent constriction of the nasal passages that proves unyielding to the methods already mentioned, the cautery is indicated. The electro-cautery is the most effective, but in its absence chemical cauteries can be substituted. A detailed description of the apparatus and methods will be found in the treatment of hypertrophic rhinitis. The question of proper clothing is considered in the treatment of acute rhinitis.

Suprarenal extract has proven beneficial in cases of nasal hydrorrhœa. B. Berens has reported the cure of a patient with hydrorrhœa by the use of suprarenal extract in 5-grain doses every three hours. C. P. Linhart reports, as being equally effective, a spray of Dobell's solution with a drachm of suprarenal extract to the ounce. His patient had a recurrence of the discharge in the winter, but it yielded promptly to the same local treatment. ("American Year-book," 1902.)

CEREBRO-SPINAL RHINORRHŒA.

The escape of cerebro-spinal fluid by way of one or both nostrils is of infrequent occurrence. The amount of fluid exuded varies from a slight quantity to a pint or more in twenty-four hours, and handkerchiefs wet with it dry stiffened. The discharge may be intermittent or almost continuous. The differentiation between this affection and common nasal hydrorrhœa, and discharges originating in the cavities accessory to the nose, is attended with some difficulty. The excessive serous and sero-mucous flux in hay fever is suggestive of the escape of cerebro-spinal fluid.

St. Clair Thompson presented an elaborate paper on this subject before the British Medical Association in 1898. He believed that in the majority of cases reported the condition was not a distinct morbid entity, but a symptom of various affections, and that it is necessary to avoid anything that might lead to infection. He recommended such treatment, only, as is useful in hay fever, employed the electrocautery with moderation, if at all, and depended largely on climatic and general tonic remedies.

L. Hektoen has reported a case in which C. Fenger removed what appeared to be a polyp from the nose, but it proved to be a portion of a meningocele. An opening was made through the face, and the edges of the dura were sutured. A prompt and permanent cure resulted.

"Hektoen thinks the route of escape of the fluid is along the perineural sheaths of the olfactory nerves. Treatment promises little, but early recognition of the condition may prevent infection of the meninges through the nose." ("Year-book of the Nose, Throat, and Ear," 1901.)

In some instances it has been observed that when the flow ceased for a time symptoms of cerebral pressure developed. These were relieved soon after an abundant discharge of clear fluid from the nose occurred, the composition of which was identical with that of the cerebro-spinal fluid.

CHAPTER III.

DISEASES OF THE NASAL CAVITIES *(Continued).*

HAY FEVER.

Synonyms.—Nervous catarrh; nervous coryza; hay asthma; rose cold; June cold; July cold; peach cold; summer catarrh; autumnal catarrh; pollen poisoning. The Latin equivalents are catarrhus æstivus; coryza vasomotoria periodica. French equivalents: catarrhe d'été; catarrhe de foin. German equivalents: Frühsommer-catarrh; Heu-asthma. Italian equivalent: asma dei mietitori.

Pathology.—In a paper read before the Section on Psychological Medicine and Nervous Diseases of the Ninth International Medical Congress in Washington in 1887, the author argued the neurotic character of this disease. The assembly, which was very large and representative, agreed almost unanimously to the theory that hay fever is a neurosis. Only three members who participated in the discussion dissented from this view.

The name "hay fever" is a misnomer. It is employed to designate a condition to which numerous other terms have been applied with equal fitness. To the array of names already in use, ill-chosen because they are misleading, the author had the temerity to add another. In a published lecture, delivered in the Chicago Medical College in 1885, he proposed the term "nervous catarrh." Since then several authors have adopted this expression. One writer, however, calls it nervous coryza; but coryza is from the Greek *κόρυζα*, signifying only a running at the nose, while the word catarrh, from *καταῤῥέω*, admits of a much broader application and, with properly modifying adjectives, may be used to designate affections of various mucous membranes. Coryza is a specific term; catarrh is generic, and obviously is the more correct one to characterize a disease which is not necessarily confined to the nasal cavities. Nervous catarrh is so comprehensive a term, and is so tersely suggestive of the pathology and symptomatology of certain neurotic derangements, as to be susceptible of a much larger usefulness than has been accorded it. To illustrate: There is a truly nervous intestinal catarrh which attacks and leaves a certain class of individuals of the nervous temperament as suddenly as an attack of hay fever does. The writer has known a musician to suffer from severe attacks of diarrhœa just previously to his appearance before an audience which he was announced to entertain. Immediately after his performance all symptoms of intestinal disturbance would vanish, only to return again at his next appearance in public. We might cite a case of an orator of the evening who was similarly afflicted. The nervousness induced by the contemplation of addressing his audience would so react on the nervous supply of the intestinal tract as to cause sudden and copious diarrhœa. No sooner would his oration be finished than all unpleasant symptoms ceased. I have known surgeons to be similarly affected. We have nervous dyspepsia occasioned by mental emotions. A certain combination of objective and subjective causes operating on one individual produces morbid phenomena referable to the mucous membrane of the turbinated bodies, resulting in an attack of hay fever,—nasal nervous catarrh. In another, the seat of the resulting manifestations will be in the bronchial mucous membrane, eventuating in an attack of asthma, —bronchial nervous catarrh. In yet another the intestinal mucous coats are the scene of this breaking of a nerve-storm, resulting in copious watery discharges,—intestinal nervous catarrh. All these are undoubtedly co-ordinate morbid conditions of the nervous system, finding expression in exaggerated and perverted functional activity.

The pathology of this disease has been evolved from a chaotic state, in which it remained from the time of its first description by John Bostock, of London, in 1819, until recent years. Instead of looking upon hay fever as a simple congestion or inflammation of the Schneiderian membrane, as eminent English authorities have in the past, prominent American authors favor the neurotic theory. In this connection it is interesting to note that a writer for the London *Lancet* treats of common nasal catarrh as a reflex neurosis, and, in support of his position, adduces numerous instances in which purely nerve-remedies succeeded in arresting attacks of acute coryza.

Although this malady is essentially due to an abnormal susceptibility of nervous tissue, there exists no organic lesion of the nervous centres to which the disease is attributable. Being a functional disturbance, it never destroys life, and no opportunity is afforded the neuropathologist to make post-mortem observations. But, if the affection be a reflex neurosis, can we hope for microscopy to determine with precision the condition of nervous structure which primarily constitutes the disease?

The arrangement of the nervous supply of the respiratory passages is favorable to the existence of reflex nervous phenomena. One sympathetic nervous centre, the sphenopalatine ganglion, supplies branches to the lining membrane of the nose, pharynx, and Eustachian tubes. It has a motor, a sensory, and a sympathetic root. It communicates with the facial and pneumogastric nerves, thus uniting in the closest connection the nose, pharynx, middle ear, larynx, and bronchi. Furthermore, the Schneiderian membrane is continuous with the lining membrane of the nasal duct and eyelids, the pharynx, Eustachian tubes and tympana, the larynx, trachea, and bronchial tubes. Ablation of the sphenopalatine ganglion sets up a severe catarrhal state of the Schneiderian membrane. A congestion once started in this structure may extend with unobstructed facility to the contiguous membranes, very like the spreading of an erysipelatous inflammation from one area of the skin to another. But the continuousness of the membranes throughout these various organs does not satisfactorily account for all the symptoms produced in one part by impressions upon another. Certainly an inflammation in the throat may extend along the Eustachian tube to the tympanum, but there is no such reason to account for the sudden transitory tinnitus aurium which occurs in some persons immediately upon the ingestion of a draught of cold water or the inhalation of tobacco-smoke, or for the cough which is occasioned by the contact of instruments with the external auditory meatus or with the inferior turbinated body or the septum nasi, or for the paroxysm of sneezing produced by irritating the scalp. All these symptoms are examples of reflex nervous impulses, and these intimate sympathetic relations between various portions of the animal economy exhibit themselves with exceptional force in patients of a nervous temperament.

The theory that lesions situated in the nasal cavities may be responsible for the existence of common asthma is generally accepted, and this is directly in the line of our reasoning, for it argues the reflex neurotic character of a disease which possesses close kinship to hay fever not only in its etiology, symptomatology, and therapeutics, but in the morphology of its secretions. The manner in which exciting causes bring about attacks in hay fever is much the same as in the case of asthma. In a hay-fever subject, let brilliant rays of light fall upon the retina, or dust impinge upon a sensitive area of mucous membrane, and what occurs? The end-organs of the sensory nerves supplying the part affected, being oversensitive to the presence of that particular kind of stimulus, are instantly thrown into a state of intense excitation or irritation. Immediately the impression is flashed along the sensory nerves to a nervous centre,—brain or ganglion; thence, changed to motor impulse, it is switched back, on the one hand, along the vasomotor nerves to the blood-vessels of the seat of irritation, causing dilatation, engorgement, swelling, and flux; and, on the other hand, along the pneumogastric and sympathetic nerves to the muscles concerned in the act of sneezing, and, through extensive sympathetic nervous relations, all the respiratory tract and its connections may participate in the disturbance and become involved in a fully developed attack of hay asthma, — sneezing, coughing, wheezing, nasal flux, expectoration, and lacrymation.

It appears, from the manner in which the paroxysms of hay fever are started and developed, that there are three conditions upon which the existence of the disease depends: (1) abnormally susceptible nerve-centres, (2) hyperæsthesia of the peripheral termini of the sensory nerves, and (3) the presence of one of a large variety of irritating agents. Exclude one of these conditions and the paroxysms are prevented. Allay the susceptibility of the nervous centres by certain cerebral sedatives, and an attack is averted or arrested. Anæsthetize the nervous supply of the oversensitive areas and the result is the same. Remove the patient beyond the reach of exciting causes and he is as comfortable as any mortal.

Another fact in support of the theory that this is a functional disease of the nervous system is its hereditary character. We might quote many illustrative cases, but three representative ones will suffice: In Dr. Morrill Wyman's family there were six sufferers from hay fever besides himself. In the family of the Rev. Henry Ward Beecher there were two besides himself; and in the family of Chief-Justice Shaw there were six members who had different forms of this distressing malady. To be sure, heredity alone does not establish a neurotic character; but, taken in connection with all the other facts in the case, it is a weighty argument in support of the assertion that this is a constitutional disorder of a neurotic type.

Again, the nervous temperament is the predominating one in this class of patients,—an argument which needs no elucidation,— and the same may be remarked concerning asthmatic sufferers. The periodicity of the disease points to nothing if not to its nervous nature, for one cannot conceive how the pollen theorists from their point of view can reconcile this feature of the complaint with their own doctrine. Is it reasonable to assume that the pollen of various plants that give rise to attacks in different individuals will be set free to float away on their fructifying pilgrimages on exactly the same day, and at nearly the same hour, each recurring year, and that they will reach the nostrils of sufferers in their varying localities and situations and vocations simultaneously year after year? The variations that occur in the yearly advance of the seasons preclude this hypothesis. And, again, the identity of the different forms of the malady strengthens the nerve theory, while it weakens the pollen argument, for it shows that the disease exists under conditions that are the least favorable to the operation of pollen; in fact, where the pollen theory is inadmissible,—in the winter and spring. The author does not undervalue the importance of pollen as an exciting cause, but he wishes to be understood as maintaining that it constitutes only one of three factors which render the existence of the disease possible.

Other arguments that may be briefly mentioned are the suddenness of the onset and disappearance of attacks, the fact that the most potent palliatives are nerve-sedatives, tonics, and stimulants, and that mental emotion and physical exertion may prevent or arrest paroxysms.

The chief argument urged against the nerve theory is that many hay-fever patients have diseased nasal cavities. But we may say the same of that much larger proportion of our population who have no experience with hay fever. That we should find nasal hypertrophies, etc., concurrent with hay fever is not surprising in this catarrh-producing climate. Indeed, the diseased turbinated tissue may be a coincidence or sequence rather than the cause, for it is natural to suppose that years of constantly recurring attacks of even functional disturbance of the vasomotor supply of these parts would result in a passive hyperæmia which would eventuate in proliferation of cells in mucous and submucous tissues, and the growth of hypertrophies which might serve as a nest for the reception and retention of irritating agents. But the argument that this condition is responsible for hay fever in infants, youths, and even in adults in whom there is no evidence of inflammatory changes before or between attacks is not tenable. The paroxysms do not so much resemble symptoms of an inflammation as they do an irregular and explosive discharge of a superfluity of nervous force,—a nerve-storm, if the expression may be permitted.

It has been hoped that destructive treatment of the sensitive areas in the nasal cavities would permanently cure hay fever, and many cases have been so treated by American physicians during the last twenty years. However, the most sanguine practitioners of this method have confessed considerable disappointment at the results. Some cases that were supposed to have been cured still suffer, while others are benefited. So far as we have been able to obtain definite data, they demonstrate that not much more than one-half the number cauterized are claimed to be cured. This points to the fact that it is not a simple local inflammatory disease. If it were, the treatment should be attended with greater success. For the reasons set forth one cannot expect this method to cure all; but, granting that it may cure many, the nerve theory would not suffer in the least by the admission, for it assumes a pathological condition of the receptive end-organs of the nerves as well as of the perceptive nerve-centres. Eliminate the susceptibility of either the central or peripheral nervous system, and you remove an essential element in the disease,—destroy its entity. But what shall we say of that other large proportion of patients in whom paroxysms are produced by irritation of the retina, the scalp, etc., or by chilling the skin? Are we to be logical and, reasoning from analogy, must we destroy the sensitive areas, enucleate our patients' eyes, or scalp or skin them? Yet, if you follow the reasoning of this school of theorists to its logical conclusion, it will lead to this *reductio ad absurdum*.

The neurotic theory is supported by the nature of the following causes: Electric light and gaslight; overexertion; anxiety; indigestion; dampness; chills; gases; feathers; perfumes; odors from animals; dry, hot, and impure air; various kinds of fruit, etc. It will be observed that pollen and dust do not necessarily enter into the causative nature of these excitants.

This theory receives support also from the fact of the excessive irritability and nervousness which patients experience just preceding and during attacks. The co-ordinate action of muscles is affected, and they complain of feeling jerky and ill-tempered for the time.

In studying this disease it should not be forgotten that the statements of sufferers relative to the history and phenomena of their maladies should be given greater credence than is usually accorded the assertions of other classes of patients, inasmuch as they enjoy the distinction of being superior to the average in intelligence and culture. This is far from being an idle assertion, for it voices the experience of the best authorities and is borne out by reference to the list of membership of the United States Hay Fever Association.

We cannot consider the treatment of this subject as approaching completeness without referring briefly to two other important points. Microscopists have examined the nasal and bronchial secretions from hay-fever and asthmatic sufferers, with the result, it is claimed, of establishing the kinship of the two diseases by demonstrating the presence in both of products called "gravel." It is believed that this so-called gravel accumulates in the secretions of the respiratory passages, and acts as a local irritant in the same manner that any foreign body would. Analysis may demonstrate that this gravel consists of deposits of urate of sodium.

The force and analogy apparent in the following facts relating to neuroses of the skin serve to emphasize the truth in the nerve theory: Intense itching over the surface of the whole body may be produced by morbid alterations in the ovaries or uterus, anomalies of menstruation, diseases of the kidneys, liver, etc. Neumann says: "There is no doubt that a large proportion of cutaneous diseases depend upon disorders of the vasomotor nerves which cause certain derangements of circulation in the arteries, veins, and cutaneous glands. Anæmia and hyperæmia of the skin happen from vasomotor irregularities,—some from the brain, some from the spinal cord,—or from the action of cold, or the electric current, etc."

Now, since it is admitted that there are both immediate and reflex functional nervous disorders of the skin, with what show of reason can it be denied that there are similar neurotic disturbances of that other skin which covers the interior surfaces of the body? The latter membrane is more vascular, more delicate, more sensitive, and more highly organized than the skin. It possesses susceptibility to all agents which affect the skin, and to many others besides. For example, noxious gases, to which the skin is insensible, will irritate the mucous lining of the respiratory organs. The same laws that govern the action of the vasomotor nerves of the skin also regulate the vasomotor supply of the mucous membranes. If itching and burning of the skin are produced by morbid alterations in the ovaries, so is pruritis urethræ produced by disease of the bladder; pruritus nasi is generally accepted as a sign of worms in children; urticaria results from irritation of the gastric or intestinal mucous membrane; so may asthma arise in the same manner or from an irritant applied to the nasal mucous surface; ear-cough is occasioned by contact of instruments with the skin of the external auditory canal; and hay-fever paroxysms result from irritation of the retina, the upper lip, or the scalp, or from chilling the skin.

All the facts in our possession force us to the conclusion that the weight of testimony is in favor of the doctrine that hay fever is a reflex functional nervous disease.

URIC ACID AS A CAUSE OF HAY FEVER.

Uric acid exists in the blood in the proportion of about one to forty or more of urea in health. When this proportion is disturbed by a relative increase of the uric acid, certain disturbances of a vascular and neurotic character arise. The effects of uric acid in producing these disturbances have been the subject of an extensive and interesting series of experiments by Alexander Haig. For years he was a sufferer from migraine, and studied in his own person the relation of uric acid to the production of attacks of this disease, and the effects of anti-uric-acid treatment in subduing attacks, and of diet in preventing them.

I have found the proportion of uric acid to urea in hay fever as high as 1 to 25 and 1 to 13, while 21 grains of the acid were being excreted in twenty-four hours. C. W. Purdy (1900) gives the proportion of uric acid to urea as 1 to 45 in health, and the secretion of uric acid as 6 to 12 grains *per diem*. Parke's "Hygiene" gives the same figures. Heitzman (1899) gives the proportions as 1 to 45, and 7 to 12 grains of uric acid. Bartley's "Chemistry" (1898) gives the proportion as 1 to 40 or 50, and the secretion of uric acid as 6 to 15 grains. Bouchard gives 1 to 45, and 8 grains as the normal amount of uric acid secreted in twenty-four hours. (J. Allen Patton, January, 1902.)

First, let us consider what the effects of an excess of uric acid in the blood are. The disorders of the nervous system that Murchison associated with lithæmia are: aching pains in the limbs, lassitude, pain in the shoulder, hepatic neuralgia, severe cramps in the legs, headache, vertigo and temporary dimness of vision, convulsions, paralysis, noises in the ears, sleeplessness, depression of spirits, irritability of temper, cerebral symptoms, and a typhoid state.

Haig maintains that the presence of uric acid in excess accounts for the exacerbation of pains in rheumatism and gout, and Lever contends that these diseases are primarily due to the action of this acid on the brain, the spinal cord, or the solar plexus of nerves. In persons suffering from intense pruritus, uric acid and the urates have been found in excess.

Ebstein believes that uric-acid deposition acts as an exciter of inflammation in the tissues in which it is deposited.

Quinquaud studied the effects of uric acid on the skin. He administered 3 to 6 grains a day to the human subject. The most common results were boils and patches resembling eczema—the dermal analogue of coryza.

Thomas J. Mays attributes attacks of angina pectoris to "the increased formation of uric acid, which is incidental to the gouty and rheumatic diathesis." He agrees with Haig in attributing migraine to the irritating effects of uric acid.

Conklin details a number of well-marked cases of nervous, mental, nephritic, and other diseases that support the proposition that they are the result of the action of uric acid.

N. S. Davis and others add the following to the list of manifestations of uricacidæmia: Loss of appetite, nausea and vomiting, flatulent indigestion, diarrhœa, intense itching, asthma, blindness, deafness, numbness of the skin and creeping sensations, hyperæsthesia and pain in the skin, impaired memory, melancholia, delirium, epilepsy, and coma.

Observe the symptoms of uric-acid irritation that are closely allied to paroxysms of nervous catarrh: Asthma, intense itching, oversensitiveness and other nervous disturbances of the skin, neuralgia, sick headache, irritability of temper, etc. The first three symptoms often characterize attacks of nervous catarrh, and highly moral persons, like the late Henry Ward Beecher, are seized with an almost irresistible impulse to accompany their storms of sneezing with a shower of profanity. Sick headache sometimes alternates with these attacks, and at other times takes the place of them.

While suffering from migraine Haig found the uric acid increased to the proportion of one in twenty or twenty-five of urea, whereas before and after attacks he found it as one to forty, and the headache was proportioned to the excess of uric acid over the urea, and not to the amount of alkali used to bring the uric acid out. The mental condition varied directly with the relative amount of uric acid in the urine. The excretion of the acid was greatly diminished before the attacks,—*i.e.*, during mental exaltation.

The author has learned, while writing upon this subject, that Leflaive analyzed the urine before and during attacks of hay fever, and found uric acid in great quantity just before the attack and half that quantity during the attack. Some of this may have been washed out of the system through the profuse perspiration that occurs during the violent sneezing.

In 1893 I proposed the uric-acid theory of hay fever in the first prize-essay of the United States Hay Fever Association, and at the meeting of the American Medical Association the same year I advocated the same theory. So far as the writer knew, he was the first to propose this doctrine. In 1894 it was brought to my attention that Shawe Tyrrel, of Toronto, had published a paper in 1892, entitled "A Predisposing Cause of Hay Fever," advocating the same theory. Independently of each other, our studies of the subject forced us to arrive at the same conclusions, and I wish to accord Dr. Tyrrel full credit for his work. Had I known of it before publishing my two essays on the subject, proper reference would have been made to his work, since it corroborated the results of the experiments and treatment pursued in my practice during several preceding years.

Haig says: "Uric acid in the blood contracts the arterioles and capillaries all over the body, producing the cold surface and extremities, raising tension of pulse, and (according to Marcy's law that pulse-rate varies inversely as the arterial tension) slowing the heart. Headache is a local vascular effect of the uric acid. Excretion of this acid may even explain the mental depression and irritability and their results in the excess of suicides and murders in July. There is an excessive secretion of this acid in the warm months, and a minus excretion in cold weather. During plus excretion there will be high arterial tension, with anæmia of the brain, bad temper, etc. At this time a dose of acid would free the brain circulation from the power of the uric acid, and produce, as Roy and Sherrington have shown, an increase in its size and a free flow of blood in its vessels."

Peiper says that alkalescence of the blood is diminished in all fevers. Corroborative of this, Haig found, during an attack of influenza in 1890, that there was a rise in the acidity of his blood, urine, and tissue-fluids, thus driving the uric acid out of these fluids, diminishing its excretion, and causing its retention in the body.

Bertillon says that suicides increased 40 per cent. in France after the influenza epidemic. This may be accounted for by the accumulation of uric acid in the body during the diminished alkalinity of the blood, and when the blood regained its normal alkalinity the stored acid was taken into the circulation and produced its characteristic irritability and depressing effects.

In health about 6 to 12 grains of uric acid are secreted every twenty-four hours, and it is readily soluble in the blood, which is slightly alkaline. If there is increased formation of this acid, no harm results so long as it is properly eliminated and the ratio between it and the urea is not disturbed.

Haig found that by diminishing the alkalinity of the blood he freed it from uric acid, relaxed the arterioles, and relieved headache and mental depression. Increasing the alkalinity augmented the acid excretion, contracted the arterioles, slowed the circulation of the blood, and caused languor, depression, headache, and, in epileptics, a fit. Epilepsy, migraine, spasmodic asthma, etc., are, like neurotic catarrh, functional nervous diseases. What Haig says concerning epilepsy and migraine may be affirmed of asthma and nervous catarrh: "They may come on early in life, last for years or the whole of life, tend to recur at more or less regular intervals, are met with in members of the same family, and may afflict one and the same patient,—now a fit, now a headache,—alternating or together. Epilepsy and headache, gout and rheumatism are very commonly met with in the same family."

Broadbent thinks that the convulsions of epilepsy are brought on by the slowing of the circulation and consequent cerebral anæmia, in the same way as convulsions after great hæmorrhage. As we have seen, the effect of an excess of uric acid in the blood-vessels is to contract them, which, in the vessels of the brain, produces cerebral anæmia. This condition appears to obtain in nervous catarrh, and the attacks are relieved by such remedies as nitrite of amyl, etc., which relieve anæmia of the brain.

The uric-acid theory of nervous catarrh is not antagonistic to the present status of medical opinion or surgical treatment, but, on the contrary, explains questions that were inexplicable before. As a tumor or hypertrophied bone may give rise to convulsive seizures in epilepsy, and as its removal may be followed by relief when no other structural cause exists, so in nervous catarrh, where new growths and other lesions of the nasal mucous membrane are present, the attack may be started by the accumulation and the suddenly setting free of uric acid. This precipitates the paroxysm by its irritant action, which finds expression in the group of symptoms characteristic of nervous catarrh or asthma, instead of some one of the other allied diseases. The particular form of manifestation may be determined by the growth, or seat of irritation, located in the nasal cavities. Where this is the only determining factor of the nature of the morbid symptoms, no other organic disease having resulted from the long-standing trouble, the removal of such a peripheral source of irritation may give relief from these symptoms, but it may not prevent the uricacidæmia from switching off into other kindred lines of disturbances if it be not corrected.

The uric-acid theory makes clear the reasons why some persons suffer from attacks of nervous coryza under certain favorable conditions in winter as well as during the warm months. It also unifies all the various forms of hay fever. They are all variations of nervous catarrh.

Patients of this class are sometimes affected more or less by functional aphasia. Haig's father suffered, from time to time for a large part of his life, from this trouble, and in old age had organic aphasia with right hemiplegia. The same functional disturbance afflicted Haig very markedly, at times of excess of uric acid in the blood, with mental depression, lethargy, and headache. The histories of such cases are paralleled by the histories of nervous catarrh in many families.

The periodicity of nervous catarrh has a counterpart in migraine that comes once in every seven, ten, fourteen, or thirty days, for years or for life. It may last one day or less, rarely two, and is worse in the morning.

In the last published paper of the late A. Reeves Jackson he expressed his conviction that various neurasthenic symptoms—sleeplessness, headache, vertigo, neuralgia, vague pelvic symptoms, muscular twitchings, vasomotor disturbances, etc.—are dependent really upon the lithic-acid diathesis. He wrote: "If this fact were duly recognized it would remove some of the cases from the list of those which are an opprobrium."

L. C. Gray says: "Influenza, ague, and other fevers store up uric acid in the body." There are several causes that determine the manner in which the irritation produced by an excess of uric acid may express itself. These are central, peripheral, and hereditary causes. "The structure of the nerve-centres and the distribution of its vessels not only determine the kind of disturbances which uricacidæmia will produce in any given case, but also explain why one person suffers in this way from functional nervous disorders, while another, with about as much uric acid in his blood and body, escapes. When the nervous system is depressed by fatigue, deficient food, etc., a smaller amount of uric acid in the blood will suffice to produce disturbance of function than at other times. If uricacidæmia is prevented, the nervous system will not itself originate disturbances. This knowledge of the effects of lithæmia gives complete power to produce or remove the vascular conditions, and the nervous disorders which are secondary to (consequent upon) these conditions, by proper diet and treatment" (Haig).

The arguments that apply to migraine are just as forceful in the case of nervous catarrh. The peripheral causes—neoplasms, hypertrophies, etc.—have already been considered.

Heredity is probably the chief factor in determining the direction in which the uric-acid diathesis will afflict an individual, whether it results in migrane, angina pectoris, asthma, nervous catarrh, or some other neurosis; but undoubtedly accidental or acquired conditions may act as directing or localizing agents. For example of the latter class: a student who is predisposed to such neurosis accidentally inhales the fumes of burning phosphorus in the laboratory, and this excites the first attack of his nervous disorder, which naturally, under these conditions, takes the form of asthma. On the other hand, many attacks of severe cold, some injury to the nose, or the development of a polypus may determine the nasal form of neurosis, or nervous catarrh. I have such cases in mind.

We can produce and control attacks of nervous catarrh at will by treatment and diet, the same as we can migraine. I was first led to experiment with an anti-uric-acid treatment of nervous catarrh by my endeavors to find a solution to the problem why paroxysms of this disease attack sufferers regularly in the morning. These attacks come on about the same time, morning after morning, although the previous afternoon and evening may have been free from suffering, and the night one of restful repose, with no direct access to dust-laden atmosphere from without and no change in the contents of the sleeping apartments. The following facts appear to answer this question: The blood is the most strongly alkaline between the small hours of the morning and 9 A.M., when it reaches its greatest alkalinity. The more alkaline the blood, the more freely soluble is the uric acid. Therefore, in the morning hours the blood is the most heavily charged with this irritant, and during these hours patients suffer the most from angina pectoris, migraine, nervous catarrh, and other functional nervous disorders.

The blood is the most acid during the hours of bodily activity, and it reaches its maximum of acidity about midnight. During this time there is only a small secretion of uric acid, and the amount circulating in the blood is minute. As the blood begins to increase in alkalinity in the morning it dissolves the uric acid out of the more alkaline tissues in which it has been stored,—the liver, spleen, cartilages, joints, and fibrous tissues,—and with the increasing alkalinity and solvent properties of the blood it becomes rich in uric acid until it produces the drowsiness, heaviness, or other nervous phenomena peculiar to any given case.

Joal found, among 127 cases of hay-fever patients, a family history pointing to the uric-acid diathesis in 107 cases, and in 67 cases among his 71 adult patients the diathesis was marked. Evidences of neurasthenia were elicited in 101 of his 127 patients. In 42 of 107 patients of all ages the nasal mucous membrane appeared to be normal.

PREDISPOSING AND AGGRAVATING CAUSES.

Heredity and the temperaments classed as nervous are, strictly speaking, the predisposing causes. Broadly speaking, whatever diminishes the powers of resistance predisposes one to attacks. Most foreign substances that are liable to come in contact with the nasal mucous membrane will provoke paroxysms, inasmuch as the mere contact of a polished silver probe will excite sneezing. Dust, pollen, infusoria; dry, hot air; cold, damp, or foggy air; smoke, gas, bright light from the sun, electric light, gaslight, sunlight reflected from snow, etc., are prolific causes. Much may depend on the character of the dust, for this is determined by the geological formation of any given locality. So wide is the distribution of dust by the varying currents of the air that places which would naturally afford immunity from this disease may be visited by storms of noxious foreign pollen. A sea-voyage is considered a certain cure for an impending attack, but even there the enemy may lurk unseen in the folds of the canvas or clothing or in the upper currents of the atmosphere. Darwin has shown that pollen has been wafted many miles over the Atlantic. Showers of pollen have fallen hundreds of miles distant from its native soil. Dust may be deposited in curtains, carpets, etc., and be retained for indefinite periods before finding lodgment in the respiratory tract. The upper strata of the air may be laden with pollen, as they are at times with volcanic dust, which may be so dense as to darken the sky at great distances from the source of supply. These truths illustrate the omnipresent and occult character of the exciting causes.

The greatest suffering occurs from May to October, especially in the country, and for the following reasons: At this season the air swarms with the fecundating dust of plants and flowers; the dry, hot air of the country is not moistened during the day except by occasional rains; the dry surface-soil affords the winds a never-failing supply of dust, and one is not protected from the dazzling brilliancy of the sun by tall buildings in the country as he may be while pursuing the vocations of city life. The streets of cities are deluged with water in summer; the dust is laid; the air is cooled and moistened by evaporation. Great buildings afford protection from the scorching rays of the sun. The denser the population, the less the vegetation and the greater the relief to asthmatics and hay-fever patients.

The irritating effect of dry, hot air causes great activity of the muciparous follicles and imposes a heavy burden on the glands to pour out sufficient mucus to keep the membrane moist. One must avoid dry heat from stoves and furnaces. Much-thumbed books and newspapers that are a little musty are exciting causes that I have not seen mentioned.

CHAPTER IV.

DISEASES OF THE NASAL CAVITIES *(Continued).*

HAY FEVER *(Concluded).*

Symptomatology.—A reciprocal relation exists between the capillary circulation of the skin and that of the internal organs, but more especially affecting the mucous membrane lining the air-passages. Let the surface of a hay-fever patient become chilled, the skin anæmic, the perspiration checked, and immediately there follow a corresponding hyperæmia of the mucous membrane of the respiratory passages, an increased activity of the muciparous follicles, exquisite tickling and painful itching in the nose and pharynx, succeeded by violent sneezing, profuse discharge of nasal mucus, suffused and tear-bedimmed eyes, photophobia, a rush of blood to the head and face, severe headache, complete occlusion of the nostrils, nervous exhaustion, and such a desperate shaking up of the whole being as is comparable to a wrecked vessel in a terrific storm. But in this violent agitation of the body we may discern a blessing in disguise, for it restores the balance of circulation to the skin, the temperature rises, the sudoriferous glands resume their activity, and the skin is again bathed in perspiration. At this juncture the vicarious suffering of the respiratory surface is relieved and the normal equipoise of functional activity ensues. In one who suffers from the asthmatic form of hay fever, to the symptoms already enumerated should be added the characteristic symptoms of asthma proper. These alone make one's lot hard enough, but when added to the so-called "aristocratic" disease they present a highly colored picture of the refinement of torture.

The sneezing is often so violent and continuous that the patient is scarcely able to catch sufficient breath to properly oxygenate the blood. The hydrorrhœa is so profuse as to saturate many handkerchiefs—a dozen or a score in a day in severe cases. One peculiar symptom I have observed, but have never seen mentioned by other writers, is: The instant some patients begin to sneeze, they also swell up so that the clothes about the abdomen and waist must immediately be loosened to afford relief from the constriction.

These attacks come on at precisely the same time and last the same length of time at each recurring season. A sudden mental excitement may prevent an impending paroxysm or abbreviate one after its onset. The attack is as instantaneous in its invasion as asthma, striking one at any moment of day or night, awaking one from sound slumber, or taking one unawares during the pleasant engagements of the day, and leaving as quickly and mysteriously as it came.

Some functional nervous diseases are transmutable, one into another. The author has witnessed cerebral hyperæmia decline and disappear as hay fever superseded it, and after several years' duration the hay fever has, in turn, been displaced by asthma, as spasmodic and characteristic in its nature as the hay fever itself. Simple asthma may not only supplant, but may complicate it, constituting hay asthma proper.

Inspection of the nasal cavities during attacks reveals the turbinated bodies enormously swollen and water-soaked, the mucous membrane very vascular, and the passages completely closed. The membrane is exquisitely sensitive and often painful. In sleep it is necessary to breathe through the mouth, which occasions distressing dryness of the throat. The breath must be held while masticating or swallowing food, and with every act of deglutition the air is forced into the Eustachian tubes, and even particles of food seem to take the same course.

In the intervals between the seasons of suffering, and even between paroxysms from day to day, the nasal membrane may present no unusual appearance. Indeed, just before a seizure the nostrils may seem more patulous than normal, affording perfect freedom of respiration. In some cases we have been unable to find any appearance whatever of a diseased condition between attacks. Others have the same hypertrophies that are common to other patients.

There are considerable variations in the experiences of hay-fever sufferers, both with respect to their symptoms and the times of their attacks. It is very common for them to awaken in the morning feeling perfectly well, with the nasal passages comfortable and free; but the moment they arise and touch their bare feet to the cool floor, or feel the air strike the lower extremities or body, or even before rising, a few minutes of wakefulness are followed by sensations of dryness and irritation in the nose and miserable paroxysms of sneezing, as though they had taken a severe cold. The attack may last for a few minutes only, or until the morning meal with coffee, when all the symptoms subside. The attacks may reappear at intervals during the day, with or without a feeling of rawness of the nasal membrane between the spasms of sneezing.

Unlike the occasional sneeze of an individual who is not subject to hay fever, the act of sneezing is unaccompanied by any sense of pleasure or satisfaction. It is positively distressing, and makes the sufferer wretched. He is harassed by a consciousness of impatience and irritability of temper; his muscles act in a jerky, inco-ordinate way, causing him to drop things or knock them together; he must always be on the alert to avoid or escape those excitants of suffering that beset his path on every hand.

The time these attacks usually come on is the 18th of August, but may vary from the 12th to the 20th in different individuals, although there is little, if any, variation in the case of any given patient. The season of suffering generally lasts until a severe frost occurs in September or October, when the season ends, and the refugees who have fled to the mountains or lakes of immune regions return to their homes to enjoy life until the following summer. In a small proportion of cases the attacks are more or less perennial. Exposure to sunlight reflected from snow, or to close, hot, impure, or dusty air in winter, will result in suffering. Some are attacked in June or in July, when certain grasses ripen and the haying season is at hand. The presence of roses or certain other flowers may provoke sneezing at any season.

Diagnosis.—Considering the characteristics and the description given, the matter of diagnosis is so simple as to require no further mention.

Prognosis.—Hay fever is not dangerous to life, although it causes serious suffering and incapacitates one for business while it lasts. It does not tend to disappear of itself permanently, but is amenable to treatment.

Abortive Treatment.—With the uric-acid phenomena in mind, I attempted to break up the morning attacks of sneezing and nasal stenosis by doses of acid at bedtime and on first awakening in the morning. The experiment was a success. A series of wretched mornings was followed by freedom of respiration and a sense of well-being that seemed like a physical millennium. After this result of preventing the morning increase in the alkalinity of the blood, in order to prove the correctness of his deductions, the writer used an alkaline treatment, and was both delighted and disgusted with the results. The old enemy raged again, but here was clinical proof of his first proposition. These experiments have been successfully repeated until I am satisfied of the correctness of these conclusions.

The first acid used for these experiments was the dilute sulphuric acid in doses of 20 or 30 drops in water, but, on account of the griping pains and diarrhœa that it produced in the early morning, we were obliged to substitute another. It occurred to me to try Horsford's acid phosphate that I had used for other purposes for some years, on the recommendation of the late Professor Jewell.

We used teaspoonful doses of this acid without any ill effects, and with the result of giving complete immunity from suffering. One or two teaspoonfuls in a glass of water at bedtime and on first awakening in the morning were sufficient to break up the habit entirely. In a few days, after the symptoms ceased to appear in the morning, this dose was omitted. The night dose was continued until the habit seemed to be entirely broken up. If any nasal irritation reappeared, a dose or two would dispel it. By adding sugar to this acidulated drink it makes an agreeable lemonade, but it is better to avoid the sugar, and as much as possible all other uric-acid-producing substances.

While the author has depended on the mineral acids to keep down the morning alkalinity of the blood, Bence Jones claims that citric acid (lemonade) will accomplish the same result. We have made it a point to have the morning dose well diluted with water, for the purpose of starting perspiration, for we have observed that as soon as a patient has sneezed violently enough to produce free sweating the symptoms either decreased or disappeared. The sweating carries off uric acid and helps to free the blood.

I am aware of the differences of opinion that exist concerning the influence of an excess of dilute phosphoric acid on the elimination of uric acid, the effects of acid on the tubules of the kidneys, and the relation of a meat-and-vegetable diet to the formation of uric acid. We are careful to use only so much acid as is required to prevent the maximum of alkalinity from occurring. The acid is used not with the expectation of eliminating, but of clearing the blood of uric acid, for the purpose of preventing attacks during the season of suffering. If the overwrought nerves are relieved of this source of irritation, they are much less likely to respond to other excitants; and, if the morbidly susceptible condition of the nervous centres is due to the action of the uric acid, its oversensitiveness to all excitants may be relieved by correcting the uricacidæmia. After relieving the suffering with the acid phosphate I have produced it again by neutralizing the acid with an excess of bicarbonate of sodium and employing the usual doses. This converted the acid into a ready solvent of uric acid, flooded the blood with it, and produced the attacks. In turn, I have followed this up with the acid, relieved all the catarrhal symptoms by precipitating the uric acid from the blood into the tissues, and produced the characteristic gouty pains. Again, by substituting drachm doses of phosphate of sodium for the acid I have precipitated all the symptoms of a severe nasal catarrh.

Some other remedies produce effects parallel to the acid treatment. Nitroglycerin, nitrite of sodium, nitrite of amyl, antipyrin, etc., have a similar effect. Opium raises the acidity of urine, diminishes the alkalinity of the blood, and reduces the amount of uric acid. It relaxes.the arterioles and improves the circulation of the brain. Iron and lead have a similar effect. Mercury reduces the excretion of uric acid, reduces tension of pulse, and produces diuresis. If opium is employed, its ill effects should be prevented by following up its use with salicylate of soda for a few days to free the system of uric acid. Quinine, so generally used, is contra-indicated, for, according to Quain, it brings uric acid into the blood.

There is one remedy that has proved, in my hands, invariably unfailing in giving relief, especially when given at the beginning of an attack of nervous catarrh or common colds. It is for temporary use only, like the acid treatment. The author has employed it for the last twenty years or more, but in this case it is, like old wine, the better for age. This is a combination of atropia and morphia, in the proportion of 1 part of atropia to 50 of morphia. The ordinary adult dose is from $^1/_{16}$ to $^1/_8$ grain of this mixture, according to the severity of the attack. It may be repeated in an hour or two, if the first dose does not entirely relieve the sneezing, running at the nose, and stenosis. I do not believe it has ever failed to stop an attack when properly adapted to the case. No person has ever acquired the drug habit through my prescribing it. I never write a prescription for it nor allow a patient to know the composition of the remedy,—not for mercenary purposes, for it is more often given away than charged for, but in order to obviate the possibility of being responsible for a drug habit. The morphia clears the blood of uric acid, diminishes the nervous irritability, suppresses oversecretion from the muciparous glands, and stimulates the circulation and activity of the nervous centres, while the atropia elevates the tone of the blood-vessels, quickens the pulse, decreases all the secretions except the urine, sustains bodily temperature, stimulates the respiratory centre, counteracts the constipating effect of the morphia, and acts as an antispasmodic. Caffeine, $^1/_6$ grain, may be added to this dose to stimulate the nervous centres and kidneys. (See coryza tablets, page 21.)

Local Self-treatment.—The most useful self-treatment probably is (1) the use of a convenient pocket-inhaler (Fig. 23) that I have devised for patients who take cold easily. It is called the "camenthol inhaler." It can be used in an inconspicuous and expeditious manner in public places, where it would be impracticable to combat a sudden seizure with other and slower measures. Several gentle, prolonged inhalations should be taken through one nostril while the opposite one is closed, until the irritation is relieved. The breath should not be allowed to pass back through the inhaler, but through the mouth instead. The camphor-menthol does not become irritating to the membrane, like menthol alone, after having been used a considerable time. It is blander and more soothing than the menthol crystals, iodine, or carbolic acid. When the throat is involved, it can be inhaled through the mouth for self-treatment. (2) For home treatment, morning and night, I usually prescribe a solution of camphor-menthol in lavolin, to be sprayed into the nostrils and throat. The 1- and 3-per-cent. solutions are the most satisfactory. It is best to begin with the weaker, and increase gradually to the 3-per-cent. solution.

Joseph A. White applies a much stronger solution than the last named in the asthmatic type. He first applies a 4-per-cent. solution of cocaine, and follows this with camphor-menthol, of which he gives the following formula (Burnett, vol. ii, p. 126): Menthol, gum camphor, of each, gr. xxx; liquid cosmolin, ℥j. (The quantity of liquid cosmolin was printed as a drachm, but an ounce was probably intended.) However, this is about four times as strong as this very sensitive class of patients will generally tolerate with equanimity unless preceded by cocaine, and liquid cosmolin is not as bland a vehicle as lavolin, benzoinol, or albolene, all of which have been deprived of the irritating properties characteristic of cosmolin when applied to the nasal mucous membrane.

Excellent results have been reported from the local application of solutions of suprarenal extract during attacks to contract the blood-

LANE LIBRARY

vessels and shrink the tumefied tissues. Although the writer has employed this remedy, with chloretone as a preservative, in hay fever with somewhat less gratifying effects than others report, it will require more time to fix its value. Combined with cocaine it gives a certain amount of prompt relief, but the danger of establishing the cocaine habit militates against the use of such a formula. While the suprarenal solution relieves the nasal stenosis temporarily, it does not remove the cause of the stenosis.

Preventive Treatment.—The treatment to eliminate uric acid cannot be undertaken to advantage during the season of attacks, except so far as relates to diet and the use of lithia. Haig does not believe that excessive uric-acid formation takes place; but, from a considerable study of this subject, I am forced to the conclusion that an excess of uric acid in the system is not due alone to continued retention and storage of the small normal overflow by the renal vein, but to an increased formation also. In a conversation with N. S. Davis, that eminent authority corroborated the latter view. It follows, then, that it is necessary to reduce as much as possible the use of those foods that increase the actual formation of uric acid, such as meats, sweets, beer, wine, etc., and limit the diet largely to fruits, vegetables, milk, etc.

Exercise also aids in the excretion of uric acid, although there may be an actual increase in the amount of acid. Lange treats periodical mental depression successfully by reducing the amount of food and by systematic exercise.

A diet of milk with occasional very small quantities of egg and fish, with no other animal food, will prevent suffering from sick headache entirely, without medicinal treatment. With this diet the natural ratio between uric acid and urea—1 to 40—is maintained. Haig claims that, by a uric-acid-producing diet, one can store up in the body several ounces of uric acid in a few years, or, by a correct diet, not as many grains. He has been on such a diet over eight years with very seldom a headache. By eating meat and drinking wine two or three days in any single week, he is sure to bring on the migraine.

A course of salicylate, salicin, lithium, etc., will remove the excess of uric acid. If an alkali is given it is likely to produce uricacidæmia and precipitate an attack of the trouble we are endeavoring to prevent. For an attack, then, a dose of acid should be given to free the blood of uric acid; then the salicylate of sodium should be given for two or three days or longer, to sweep it out of the body; but the salicylate should not be given during the attack, for it may aggravate the symptoms.

For a fortnight or a month, perhaps longer, preceding the regular season of attacks of nervous catarrh, from 2 to 6 grains of the salicylate should be given every day or two, in order to get and keep the quantity of the acid in the body down to the normal amount. The copious use of the stronger lithia-waters is advantageous, also. The 5-grain tablets of the effervescing citrate of lithia are excellent, and the same may be said of alkalithia and the effervescent citrate of lithia, soda, and potash. The writer now depends almost entirely upon lithia as a preventive remedy.

Since about the year 1890 I have employed carbonate and citrate of lithium as well as various preparations of sodium, potassium, and magnesium for preventing attacks of hay fever when uricacidæmia undoubtedly was present. The success of daily, small doses of lithia, averaging 10, 15, or 20 grains *per diem* in morning and evening doses evenly divided, led me to the conclusion that other remedies that would keep the blood and urine alkaline might prove beneficial. Lithia prevented attacks that were impending or relieved those that were already causing distress, and it also averted attacks after indiscretions in diet, when a full dose was taken just after a meal of meats and sweets. The great number of times that these experiences were repeated left no room for doubt of the correctness of our deductions.

Sodium sulphate and bicarbonate, potassium sulphate and bicarbonate, and magnesium were then tried in doses of 5 and 10 grains, administered in the same manner in which lithia had been employed, with liberal quantities of water. While the results have been encouraging, the experience with these salts as preventive remedies has been so much less than with lithium that it is not yet possible to speak with the same amount of confidence regarding them as in respect to the lithium salts.

This treatment, combined with proper diet, should be successful, provided that there is no organic disease of the structures, central or peripheral. Any organic disease—hypertrophy, polypus, etc.—must receive such attention as to secure the harmonious co-ordination of all the functions, for this treatment is directed against uricacidæmia only, as a cause of suffering; but it should not be forgotten that there are other causes that may operate to produce attacks, just as in the case of spasmodic asthma arising from bronchitis, irritating gases, and other excitants.

In this connection it is worth while to note the apparent effect of an operation on the ear in relation to hay fever. In June, 1897, I removed an aural polypus and the ossicles, and curetted granulations of the middle ear under a 20-per-cent. cocaine anæsthesia in a case of long-standing chronic suppuration. The patient, who was an educator, was a hay-fever sufferer. Heretofore the attacks had come on in June and lasted until the frosts of fall. In November, 1897, the patient, who lives a considerable distance from the city, called and informed me that the operation had relieved her from hay fever, for she had escaped it entirely the past summer. The suppuration ceased; but whether the freedom from hay fever was a consequence or a coincidence is a debatable question.

The author is of the opinion that, with the present theory, improved therapeutics, and proper diet for this disease, the medical profession need no longer say to hay-fever patients, in a patronizing way, "Suffer, little children, for of such is the kingdom of heaven." But we must recognize and combat the uric-acid diathesis if we would bring comfort to these patients and obliterate a stigma that dims the lustre of our great art.

H. H. Curtis has published reports of a few cases of hay fever treated with ragweed. He believes that the cases due to ragweed may be prevented by giving from 2 to 10 drops of the tincture or fluid extract of ambrosia artemisiæfolia (ragweed) three times a day during the two weeks preceding the paroxysm. While the results were generally good, in some cases reported there was utter failure. It is thought probable that these may have been due to goldenrod or other plants. In such cases the immunizing drug should be of the same kind as that which caused the trouble. He concludes that those dependent entirely upon ragweed make up about 60 per cent. of the cases. When there is a mixed infection and a preponderance of asthmatic symptoms, a nasal spray of suprarenal extract may be used with benefit. (*Western Medical Review*, September 16, 1901.)

The possibility of producing an antitoxin for hay fever has been made the subject of investigation by Dunbar, who is an American physician and the director of the Hygienic Institute of Hamburg. The results of his experiments coincide in some respects with those of Curtis, and differ in others. The former has apparently demonstrated that the pollen of many cereals, such as corn, wheat, rye, and oats, and of grasses, contains an active principle which is soluble in the secretions of the nose, eyes, and mouth, and in the blood-serum, and which excites the irritation and characteristic paroxysms of hay fever and asthma. The fact remains that these irritants affect only those who are by predisposition particularly susceptible to them, and this predisposition remains still inexplicable. Such persons exhibit their susceptibility even when the starch rodlets of the pollen are injected hypodermically, and symptoms of coryza, conjunctivitis, and bronchial asthma develop.

Naturally these phenomena suggested to Dunbar that immunization might be possible by means of a curative serum. Carrying out this idea, he injected ainmals with pollen toxin, and in time obtained an antitoxin serum. On applying this antitoxin to the nose or eyes of persons who had been infected with pollen for a short time the irritation ceased, and it rendered pollen ineffective after being mixed with it in test-tubes.

The fact that the neutralizing effect of the antitoxin serum holds good only in cases in which it is applied shortly after the infection occurs should not discourage further efforts to produce a more ideal serum. An especially interesting deduction of Dunbar, differing from that of Curtis, is that the toxic principle of the various pollens is identical, since the injection of antitoxin obtained from one kind of pollen will neutralize the effect of pollen from a different plant.

So far as these facts affect the subject of hay fever and pollen as an exciting cause they seem to hold out promise of relief, and it is to be hoped that Dunbar's seven years of work in this line may be crowned with success; but it is a complex subject, and each case is a problem to be solved by itself. (*The Illinois Medical Bulletin*, August, 1903.)

MEDICAL OPINIONS.

We have written to a large number of specialists and writers on this subject to obtain their latest views and treatment. There were some whose recent publications made it unnecessary to write, and others who were inaccessible; so we have in such cases searched the literature and endeavored to present a fair and impartial account of the present *status* of medical opinion on the nature and treatment of hay fever. From some articles it is impossible to gather any definite knowledge of the opinions of the writers on the nature of the disease; we have stricken out much for that reason, but have, in every case presented, striven to give a natural and unbiased interpretation of the author's views. The methods of treatment often indicated these. The opinion of each writer on the pathology, whether he believes it to be a neurôtic or local affection, is indicated by a single word following his name,—*neurosis* or *local.*

E. L. SHURLY. *Neurosis.* "I am very glad that you will present the subject of the treatment of hay fever. It is a very important one, and does not receive the intellectual attention which it deserves. It is my belief that some cases can be relieved by counterirritation in almost any part of the body, as well as in the nasal passages. I also believe that its purely nasal origin is overestimated. I have found snuff of daturine with starch sometimes more effective than the galvanocautery." He uses tincture of iodine, etc., over the neck and chest, as recommended by Faulkner. If there are new growths he removes them.

W. E. CASSELBERRY. *Neurosis.* "I believe hay fever to be amenable to thorough surgical treatment, establishing a complete cure in a minority of cases only,—those particularly which present gross deformities of the septum and the turbinates, and polypi. In the large majority the condition can be materially mitigated, the degree of improvement being in accordance (1) with the degree of structural disease present in the nose and (2) with the thoroughness of the treatment. A small minority are not amenable to surgical treatment. They include the highly neurotic individuals in whose noses, between the paroxysms, little or no structural change is apparent. Much can be accomplished toward palliation by both systemic and local medicinal treatment. But in my experience medicinal treatment is nearly, if not quite, powerless to effect a permanent cure. Such, however, may take place in the course of years, perhaps, assisted by supportive and tonic treatment, as the individual's general health improves and the neurotic element lessens. Of local palliative remedies, cocaine is probably the most powerful and at the same time the most dangerous remedy. Its use and sale should be regulated by law."

C. H. KNIGHT. *Neurosis.* Destroys all enlargements. "When it is impossible to define a distinct abnormality, the nasal membrane throughout being sensitive and irritable, good results seem to me to follow painting the mucous membrane with a solution of perchloride of mercury, muriate of quinine, and glycerite of carbolic acid. Of course, general treatment is always essential. I must confess that my proportion of cures is small. I feel quite pleased if I succeed in mitigating the severity of the symptoms and lessening their duration, etc."

W. C. GLASGOW. *Neurosis.* "Surgical treatment has given little or no permanent relief. Symptomatic treatment will ameliorate the symptoms and keep the patients in comparative comfort during attacks. The constitutional treatment with potassium iodide, belladonna, antipyrin, etc., lessens the disturbance and sometimes controls it."

JONATHAN WRIGHT. *Neurosis.* "I have seen several cases with no appreciable intranasal lesion except the acute condition during the attack. I have operated a few times for intranasal lesions of various kinds. All were improved somewhat,—some markedly, some slightly. My impression is that the relief in these cases is too limited to make it of value."

R. W. Seiss. *Neurosis.* "Operations in the nose should be resorted to cautiously, and only when absolutely necessary." He recommends strychnine and bromides internally, and benzoate of sodium, 10 to 20 grains to the ounce, or menthol, 10 to 30 grains, for a spray.

E. J. Kuh. *Neurosis.* A sufferer from hay asthma. He found the most relief from the following spray: Camphor, $^{1}/_{2}$ part; menthol, 1 part; creasote, 1; oil of eucalyptus, 2; oil of pine-needles, 2; albolene, 93 $^{1}/_{2}$ parts.

J. O. Roe. *Local.* He believes that there is always a diseased condition of the nose causing hay fever. These diseased tissues must be removed or destroyed. He denies the neurotic character of the disease. He says: "Irritation reflected from other situations to the nasal chambers is not hay fever."

F. H. Bosworth. *Neurosis.* He believes that intranasal surgery affords permanent relief. This method is clear in its indications, easy of accomplishment, and promises not only more immediate, but more permanent, relief than any other method. He believes that hay fever and spasmodic asthma are pathologically identical.

J. N. Mackenzie. *Neurosis.* Better results were obtained from constitutional than from local treatment. He gives zinc, nux vomica, quinine, and arsenic.

W. H. Daly. *Local.* He believed it to be simply a deformity in the nose, and that a large proportion of cases could be cured by surgical operations.

J. Solis-Cohen. *Neurosis.* Any local nasal trouble may be simply incidental. He prescribes tonic treatment and restricts the use of meat.

Kitchen, of New York. *Local.* He believes it is due to the membrane being deficient in the epithelial covering, etc., that calls for local remedies.

B. O. Kinnear. *Neurosis.* He believes it to be due to irritation of the gray matter composing the centres of the fifth, glossopharyngeal, the facial nerves, and some of the pneumogastric. He found that treatment addressed to this condition was successful. He used the well-known icebags of J. Chapman, of Paris, along the spine between the shoulders, from the fourth cervical to the third dorsal vertebra, to dilate the arterioles of the whole body, thus evenly distributing the circulation and withdrawing the blood from the congested centres. The applications lasted from sixty to ninety minutes, one to three times a day.

M. R. Brown. *Neurosis.* The supersensitive areas should be destroyed with the cautery. Atropine, $^{1}/_{100}$ grain, once or twice daily or a 4-per-cent. solution of cocaine locally may give temporary relief.

H. H. Curtis. *Neurosis.* He sears the enlarged tissues with chromic acid in preference to all other escharotics.

C. E. de M. Sajous. *Neurosis.* He believes that if cauterization fail to cure, it is because it is not carried deeply enough. He uses glacial acetic acid or nitric acid, and he gives strychnine and coca-wine after meals.

William Cheatham, of Louisville. *Neurosis.* He praises antipyrin in 10 to 30 grains; also acetanilid, 4 to 6 grains a day.

T. M. Hardie. *Neurosis.* He believes that operations will benefit a large proportion, but constitutional treatment is necessary in most instances.

Beverly Robinson. *Neurosis.* Soothing applications and constitutional medication. He advises against surgical interference except when there are positively diseased growths.

I. Gluck. *Local.* He believes the nervous element to be a result, instead of the cause, of the disease. He uses a 10-per-cent. solution of atropine after anæsthetizing with cocaine-phenol. He gives aconitine every hour or two, affording relief and aborting attacks in from two to five days.

Carl Seiler. *Neurosis.* He uses sprays of cocaine and plugs of cotton saturated with it. A sponge worn in the nose to filter the air is recommended. Quinine in large doses is advised and tonics and atropine for the fever. In the later stages iodide and bromide of sodium are given. Morphine hypodermically is advised. All enlargements should be removed; he gives dilute phosphoric acid, 30 drops a day.

De Lamalleree. *Neurosis.* He believes it is a neurosis of nasal origin, and claims to subdue morbid sensitiveness of the membrane by douches of carbonic-acid gases locally for fifteen minutes at a time, three times a day.

Sir Andrew Clark. *Neurosis.* He resorts to constitutional remedies and applies to the nostril with a camel's hair pencil this mixture: 1 ounce each of glycerin and carbolic acid, 1 drachm of quinine, and $^{1}/_{2000}$ part of the perchloride of mercury. Heat must be used to dissolve the quinine.

P. McBride. *Neurosis.* He treats it as a nervous disease, and if this fail he uses cocaine and the galvanocautery. He deprecates indiscriminate cauterization, however.

D. B. Lees. *Neurosis.* He claims to abort it with bromide and belladonna.

John North. *Neurosis.* Employs anti-uric-acid treatment, and removes hypertrophies, with satisfactory results.

Gouguenheim. *Neurosis.* He uses nervines, and cocaine locally.

The author operates with the electrocautery or by other methods when there are indications for such measures.

PLATE III.

PLATE III.

FIGURE 1.—Male, æt, 21; anterior view of extensive osteo-enchondroma of septum, completely occluding left nasal cavity; mass reduced with dental engine.

FIGURE 2.—Lateral view of above.

FIGURE 3.—Posterior view of asymmetrical nasal cavities of above case; complete stenosis of the left naris.

FIGURE 4.—Male, æt. 44; anterior view of deviation of septum to right, causing partial occlusion of cavity.

FIGURE 5.—Lateral view of above, showing concavity of septum anteriorly and a convexity posteriorly, due to abnormal thickness of the septum.

FIGURE 6.—Posterior view of above, showing the thickened septum pressing on left middle and inferior turbinated bodies, causing asthma. Thickness reduced with surgical engine, passing burr under the mucous membrane; asthma relieved.

FIGURE 7.—Male, æt. 48; relaxation of soft palate, causing symptoms of elongated uvula; astringents found useless; amputation of uvula.

FIGURE 8.—Female, æt. 22; elongation of uvula, causing cough, expectoration, etc., and general symptoms of phthisis; amputation; complete relief.

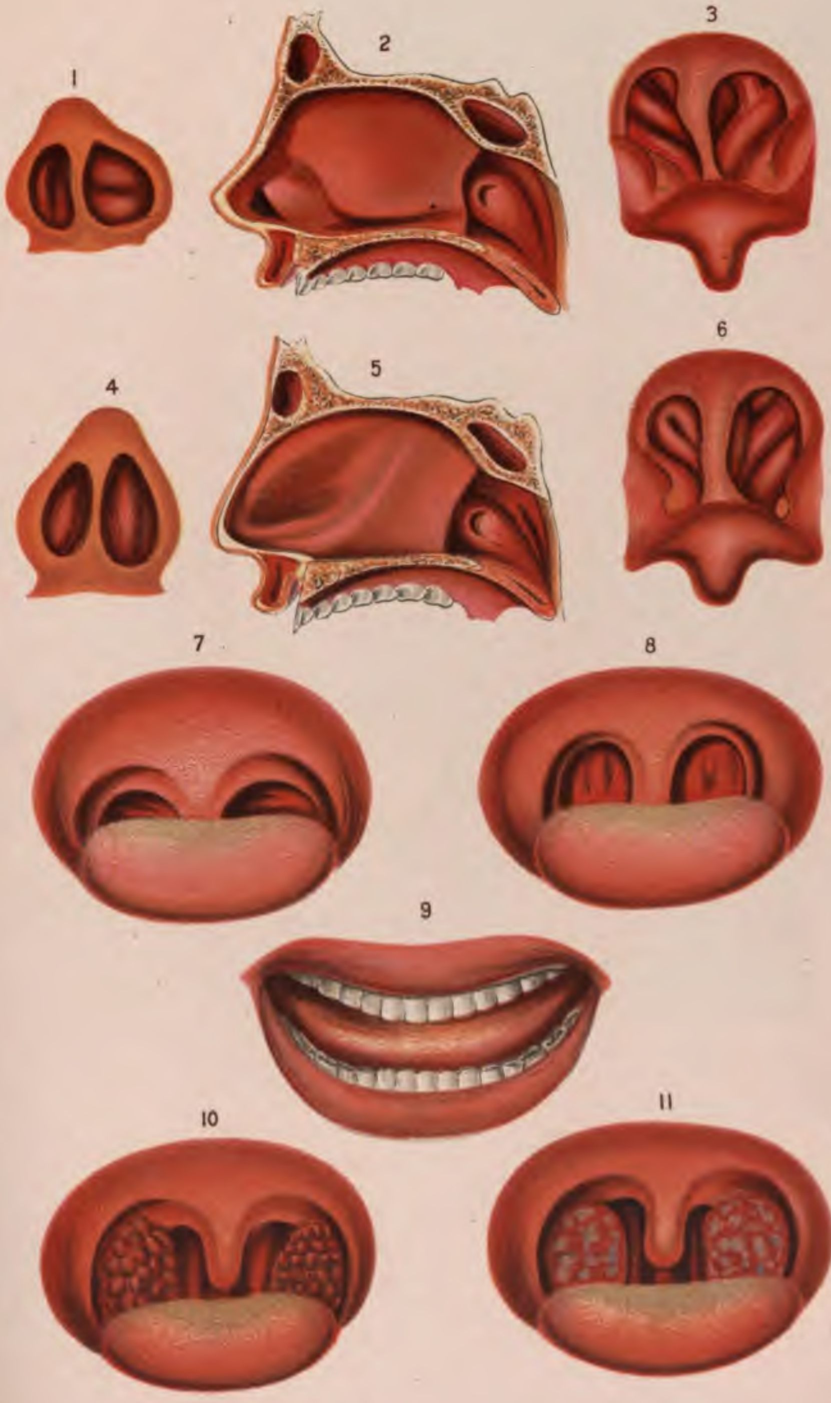
FIGURE 9.—Female, æt. 27; position of mouth in forcible separation of jaws during tonsillitis; further examination impossible; diagnosis established by character of pain, color of tongue, odor of breath, and dysphagia.

FIGURE 10.—Male, æt. 28; hypertrophy of the tonsils; amputation with tonsillotome.

FIGURE 11.—Appearance of tonsils in above case during an attack of tonsillitis.

[NOTE.—Represented as seen by gaslight. By daylight the red color appears much paler.]

PLATE III.



CHAPTER V.

DISEASES OF THE NASAL CAVITIES *(Continued).*

Hypertrophic Rhinitis.

Pathology.—In this form of nasal catarrh there is not only a thickening of the mucous membrane, but also an increase of connective-tissue formation in the submucous layer, or corpora cavernosa. The venous sinuses, having passed through the stage of vasoparesis, have now become permanently dilated. The newly formed fibrous tissue prevents their contraction and maintains them rigidly dilated

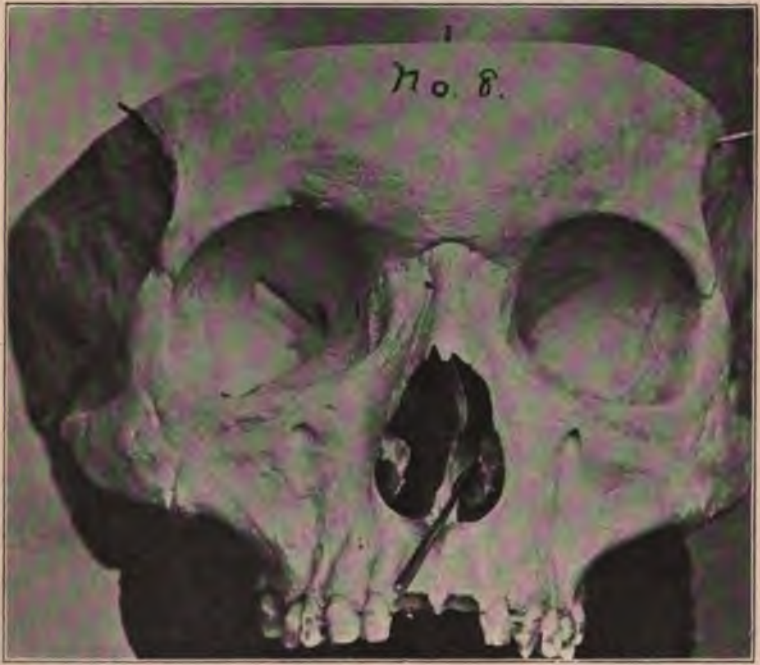


Fig. 25.—Nasal Synechia. (Author's Specimen.) Point of probe is inserted between the inferior turbinated body and the projection of the septum at the point of their union.

until pressure upon their walls by contraction of this tissue, the presence of leucocytes, or the formation of connective-tissue septa and thrombi within the sinuses finally obliterates them.

During the hypertrophic stage there is increased vascularity of the turbinals and of the septum. The most frequent situations of thickening of the membrane and tissues beneath are the posterior ends of the turbinate bodies (Plate IV and Figs. 27 to 30). Depressions and spurs of the septum nasi, ecchondroses and exostoses, and sigmoid deflections resembling corrugations are frequent accompaniments (Plate III). Occasionally adhesion occurs between the septum and turbinals, forming a bridge, or synechia (Figs. 25 and 26).

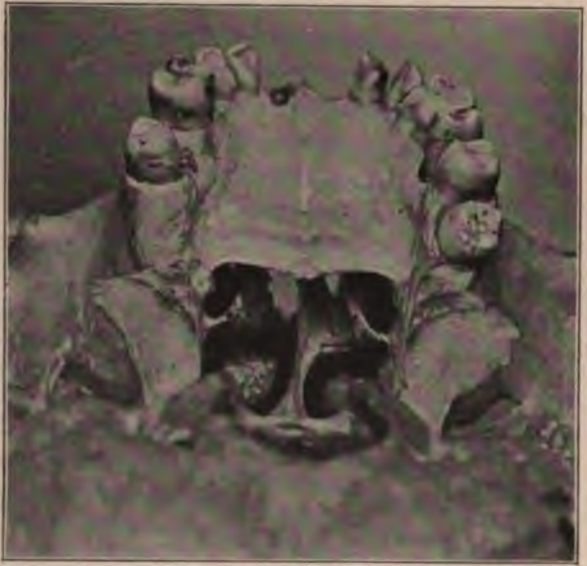


Fig. 26.—Posterior View of Osseous Bridge Shown in Fig. 25. (Author's Specimen.)

Etiology.—This is a sequel of simple chronic rhinitis.

Symptomatology.—The obstruction to the free passage of air through the nose, by great thickening and deformities of the turbinals and the septum, causes partial or complete mouth-breathing. Patients complain that they take cold easily and that when lying on one side the lower nostril closes. The latter symptom occurs in consequence of the blood gravitating to the lower turbinals and causing them to swell. A slight exposure results in stenosis of both nostrils, and as a result the constant passing of air through the throat instead of the nose dries the throat and larynx and gives rise to more or less irritation or inflammation of these parts.

When the stenosis is marked the nasal voice is a characteristic sign. Invasions of the nasal ducts and Eustachian tubes lead to involvement of the conjunctivæ and the middle ears. Watery eyes, impairment of hearing, and tinnitus aurium are common sequels of this disease. When the very young are affected the pharyngeal and oral tonsils are often found hypertrophied (Plates I and III) and require excision. Anosmia (absence of the sense of smell) and impairment of taste are occasional symptoms. When headaches are present, they are referred to the supra-orbital or frontal region.

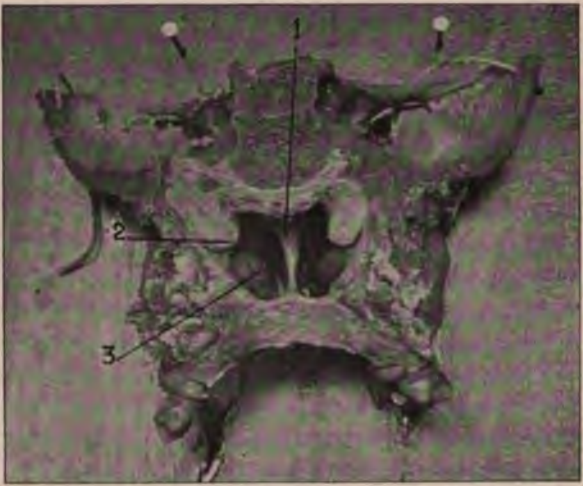


Fig. 27.—Transverse Vertical Section through the Vault of the Pharynx and Eustachian Tubes. 1, Posterior border of the vomer. 2, Eustachian tube. 3, Inferior turbinated body.

Asthmatic attacks are sometimes due to pressure of the enlarged turbinals against the septum (Fig. 56). The secretions, which are much more abundant than in health and more copious in the morning on account of their accumulation during the sleeping-hours, cause a disagreeable habit of hawking and hemming to clear the throat, especially on rising in the morning.

Diagnosis.—The septum, like the turbinals, is red and thickened, particularly near its base. The turbinals, instead of presenting a smooth, glassy surface, as in the simple form, are hypertrophied unevenly and sometimes present a somewhat nodular appearance. The inferior turbinate body usually shows the greatest enlargement, but the middle one is often found in contact with the septum. Their posterior extremities may blossom out into berry-like buds of a gray or purple color (Plate IV). The former are the commoner. Probe-pressure meets with a firm, instead of a yielding, resistance.

Prognosis.—After middle age the hypertrophies generally become absorbed and disappear, when this form often merges in atrophic catarrh. The hearing is likely to suffer, and there is a strong predisposition to catarrhal affections of the pharynx and larynx. Modern methods of surgical treatment afford an excellent prognosis.

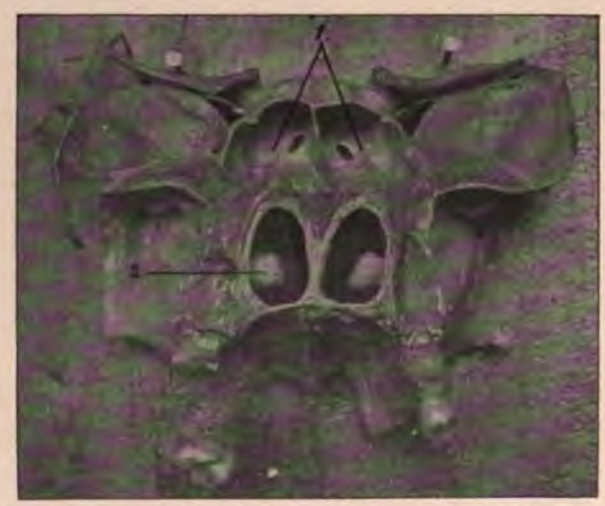


Fig. 28.—Transverse Vertical Section through the Posterior Nares. 1, Sphenoid antra. 2, Posterior end of the inferior turbinated body.

Treatment. — Cleanliness is of prime importance in this as in other forms of nasal catarrh. The solutions and methods given in treating of the simple form are indicated here, but medicinal treatment alone will not suffice to remove hypertrophies. Operative measures must be brought into requisition. Of these the electrocautery is now the most frequently resorted to except for cartilaginous and osseous outgrowths, which require the knife, saw, or the trephine. For the fibrous growths the hot or cold snare, scissors, chemical caustics, etc., are employed. We will first consider the electrical apparatus.

For physicians who practice in the country, where the incandescent electric lights are not a part of their office equipment, the Wabash cautery-battery (Fig. 31) is satisfactory. It has the advantage of a mechanism which prevents the immersion of the zinc and carbon elements in the cautery fluid except when in use. This extends the life of the battery very materially. By keeping a fresh supply of the fluid on hand for immediate use one need never be disappointed by the battery's not working. The Flemming battery, also, is effective.

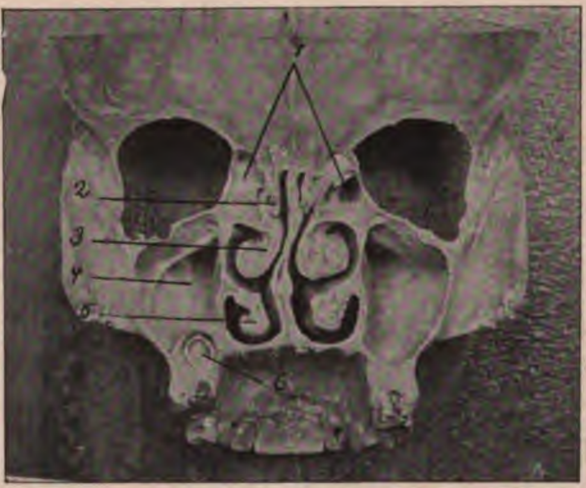


Fig. 29.—Transverse Vertical Section through the Orbits, Nasal Fossæ, and Maxillary Antra. (View from Behind.) 1, Ethmoid cells. 2, Superior turbinated body. 3, Middle turbinated body. 4, Antrum of Highmore. 5, Inferior turbinated body. 6, Embryonic tooth.

If the physician's office is wired for incandescent electric lights, or if he is not remote from conveniences for storing his battery, the one shown in Fig. 32 is to be recommended. It is more easily portable than the fluid battery, and will give a white heat. Unlike the plunge battery, it deteriorates in consequence of disuse, and is better for being worked at least three times a week. When lying idle it sulphates; that is, sulphate of lead forms on the plates and renders it inoperative.

The most thoroughly useful combined electrocautery and motor instrument with which the author has had any experience is the rotary current-transformer and dynamomotor shown in Fig. 33. Above the transformer is seen the switch, and at the left are the cautery-rheostat and cautery-handle, with the cautery-snare, ready for use with the 110-volt direct current, such as is used in Chicago.

The cautery-current furnished by this transformer has an electromotive force of 7 $^1/_2$ volts and a volume sufficient to heat the largest cautery-electrode, and it is perfectly controlled by the rheostat; so that the operator has at command and under entire control the full range of any desired strength of current. This transformer is quiet in its operation, and it may be placed in the treatment-room or in any convenient location at a distance from the operating chair by extending the wires leading from the generator to the rheostat. It has given entirely satisfactory service in my work both for cautery purposes and for operating drills, burs, etc., in connection with the dental arm. For the perfecting of this superior apparatus I am under obligations to C. S. Neiswanger, and the McIntosh Battery and Optical Company, of Chicago.

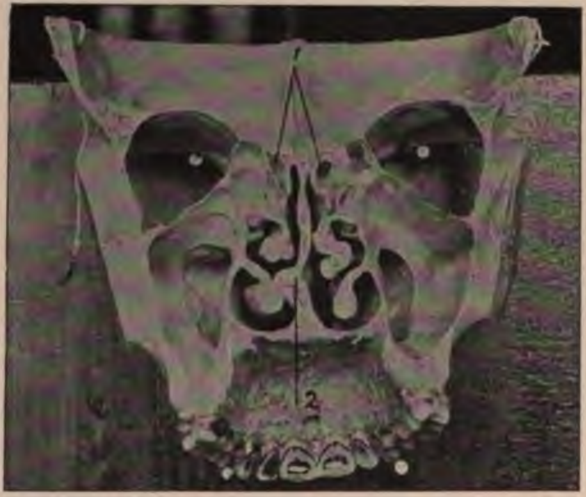


Fig. 30.—Transverse Vertical Section through the Nasal Fossæ. (View from Behind.) 1, Ethmoid cells. 2, Deflection and spur of septum with adhesion to the left inferior turbinated body.

In many of the smaller towns the electric current employed for the purposes of illumination is of the alternating kind, and is transformed for house and office purposes to a pressure of 52 or 104 volts. When this current is obtainable it is much cheaper, and more easily adapted to cautery uses, than the 110-volt direct current.

A transformer for this current is illustrated in Fig. 34. The current from the mains enters the binding-posts on the side of the instrument, and by flowing through a magnetizing coil consisting of a large number of turns of fine wire, induces a rapidly reversed flow of magnetism through a centre bundle of soft-iron wires. This flow of magnetism encircles the secondary coil, which, consisting of a few turns of very coarse wire, delivers a current of low voltage and high ampèrage to the binding-posts on the top of the instrument.

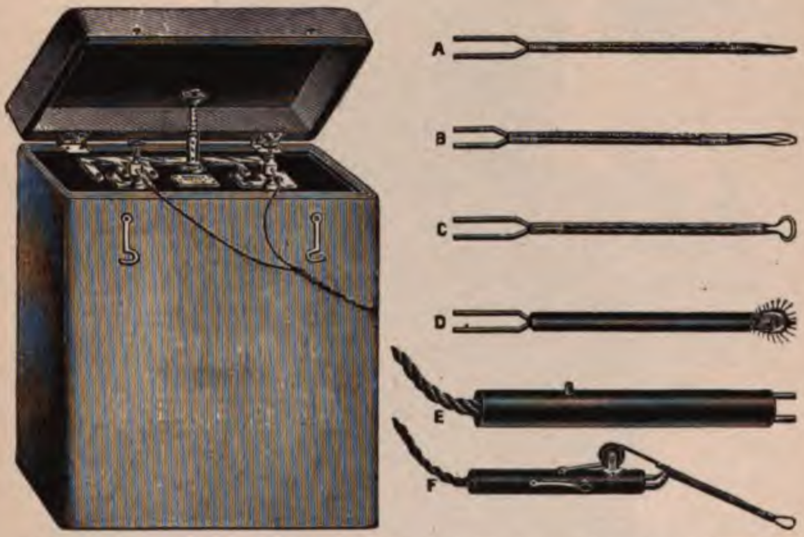


Fig. 31.—The Wabash Cautery-battery, with Electrodes, Lamp, and Handles.

By means of the hand-wheel on the transformer the secondary coil may be raised out of the magnetic field of the primary, thus diminishing the current supplying the cautery-electrode. In this manner the current is placed under absolute control; and so perfect is the adjustment that a fraction of a turn of the wheel raises or lowers the temperature of the cautery-knife a perceptible degree. The voltage of the current obtained may be varied at will from 2 to 12 volts, and it may be utilized for lighting small lamps.

The transformer, when heating the largest cautery-knife, takes from the mains about 2 ampères, and delivers to the cautery-knife 40 ampères. The large increase of current in passing through the transformer is offset by a corresponding diminution of voltage. A large volume of current at a low voltage is what is required for cautery purposes.

Figs. 31 and 35 show several of the most useful cautery-electrodes, and Fig. 36 shows a convenient handle. One must select the electrode according to the individual requirements of each case. The electrodes should fit into the handle in such a way as to permit the operator's arm to rest naturally by his side while cauterizing, the same as while using the nasal speculum (Fig. 3). They are not now so constructed, but they should be.

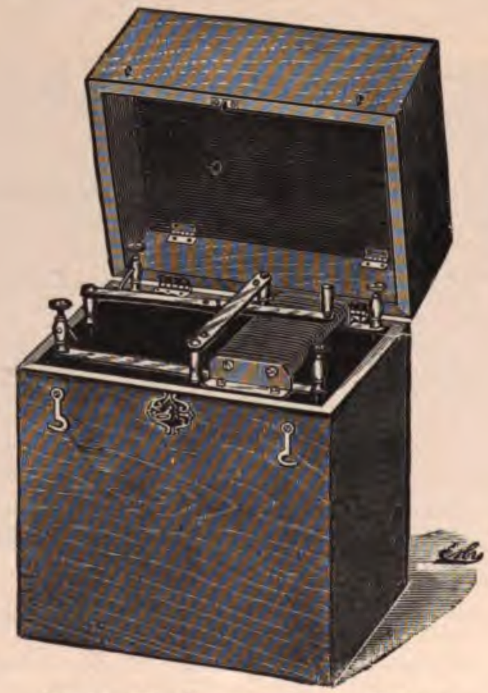


Fig. 32.—The American Storage Battery.

If the physician does not happen to have the conveniences of the electrocautery, he may resort to chromic, or nitric, or monochloracetic acid. Of these the chromic acid possesses decided advantages over the others. It is fusible into an easily manageable bead on the chromic-acid applicator (Fig. 182). To accomplish this, the platinum loop is dipped into the dry acid crystals and held over a small flame to heat. As soon as the acid begins to melt it is quickly withdrawn from the flame and blown upon to cool it rapidly into the form and size of bead desired. One should be careful not to apply the acid on a very moist surface too long, or moisture will be absorbed sufficiently to loosen the bead and allow it to fall off the loop, and thus cauterize

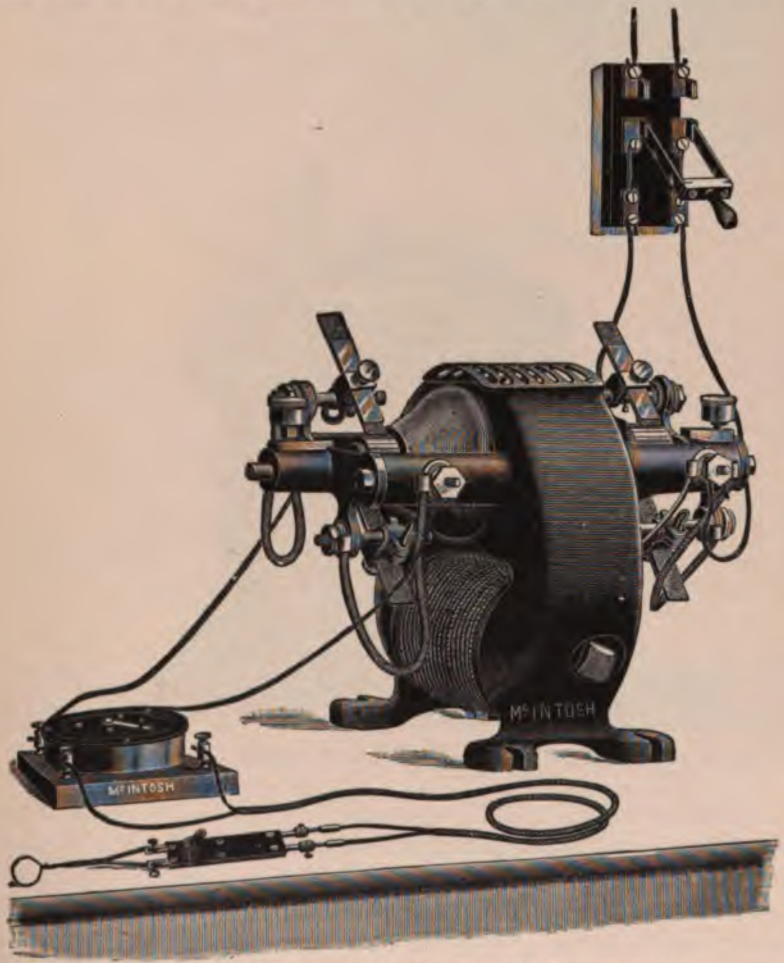


Fig. 33.—Electric-current Transformer and Dynamomotor.

tissue that does not need it. In the use of liquid acids all the surplus fluid must be pressed out of the cotton pledget by which it is applied before introducing it into the nose, otherwise it will spread over the surrounding surface.

Before any operation the part to be attacked should be rendered antiseptic. The writer applies a solution of suprarenal gland before treating the field of operation with cocaine, in order to render the operation bloodless, and to lessen the liability to any distressing manifestations of the cocaine.

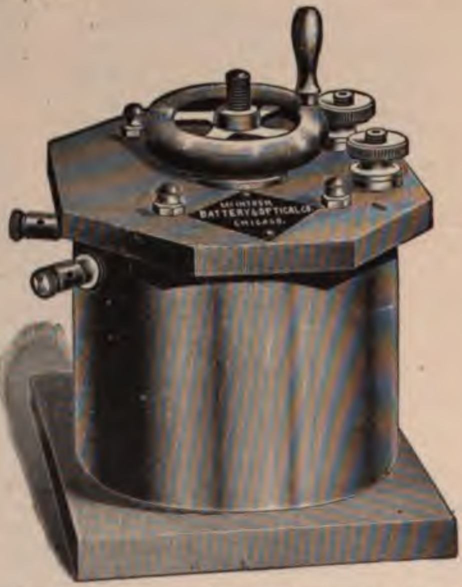


Fig. 34.—Alternating Electric-current Transformer for Cautery Purposes.

Fifteen minutes before cauterizing the mucous membrane an 8-per-cent. solution of cocaine hydrochlorate is to be applied. It must not be sprayed into the nose, for toxic effects and even collapse may result from an overdose. It is best to twist a piece of absorbent cotton loosely on the carrier (Fig. 115), dip it into the anæsthetic solution, and then adjust it nicely to the particular area we desire to cauterize and slip it off the carrier, leaving it pressed lightly between the septum and turbinal. Like the liquid acids, all the surplus of the anæsthetic solution should be pressed out in the mouth of the medicine-container before introducing it. The patient is directed not to swallow any that may trickle into his throat. In about fifteen minutes the tissues should be sufficiently anæsthetized to burn without pain. It need hardly be repeated that the membrane must be thoroughly cleansed and dried before the treatment, for if thick discharges are present they prevent the action of the drug upon the tissues as well as weaken it by dilution. The patient should incline his head forward to prevent the cocaine from entering his throat.

It is useful to instruct the patient to raise his hand if he should begin to experience any severe pain from the cautery. However, by employing a strong preparation of the anæsthetic and leaving it a considerable time, even twenty minutes, in contact with the membrane by means of the cotton pack, it is possible to burn deeply without causing much discomfort. There is an advantage in cauterizing deeply. As cicatrization takes place a furrow forms, which, together with the subsequent contraction, leaves a capacious breathing-space between the turbinate body and the septum.

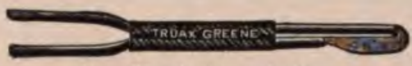


Fig. 35.—Cautery-knife.

The electrode should be used at a white heat, with care that it does not melt, or burn out, and it must not be allowed to cool while in contact with the tissue, for if it does it tears away the burned parts during its removal, and leaves a raw, unprotected, bleeding surface. It must be removed while it is still hot, care being taken to avoid touching any but the anæsthetized area. If the electrode is permitted to touch the border of the naris in its withdrawal, the resulting burn will cause much annoyance.

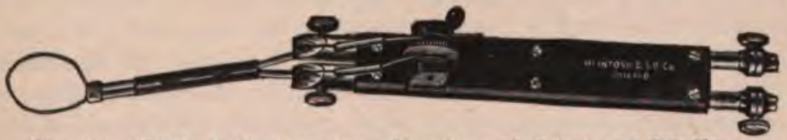


Fig. 36.—McIntosh Electrocautery Handle, with Snare and Windlass. It answers for snaring as well as for holding electrodes.

Only a small area should be cauterized at one treatment. Not more than one-third or less of the turbinate body should be treated at a single cauterization, for if more is included the reaction occasions considerable swelling, a copious serous discharge, pain, headache, irritation of the corresponding eye; and even tumefaction and discoloration of the cheek and loose areolar tissue of the lower eyelid may occur. It is generally best to allow about a week to intervene between cauterizations of the same side, but when patients from a distance can remain but a brief period the opposite turbinal can be burned in about four or five days after the first, if the operated areas are not too extensive.

After each cauterization the operated surface should be covered with a coarse spray of a 10-per-cent. solution of camphor-menthol. Should any hæmorrhage occur, the bleeding surface had best be treated with a 10-per-cent. solution of silver nitrate. If this remedy should not entirely stop the hæmorrhage, a solution of the suprarenal gland must be employed. After such a management of cases that have been properly operated upon, there is generally little or no hæmorrhage, pain, or reaction, but the parts pursue a placid course to recovery.

The use of the cautery is really a simple operation, but care must be exercised not to approach too near the orifice of the Eustachian tube. We have seen acute suppurative inflammation of the middle ear result from such procedures. Seiss, in speaking of such untoward sequels, cites cases of ear disease made worse by nasal treatment. The membrane being anæsthetized, a speculum is introduced and the light from the forehead-mirror is thrown into the nostril. The chosen electrode is introduced cold and placed on the benumbed area, when the current is turned on sufficiently to give a white glow. If the patient evinces pain, or if the electrode is seen to burn as deeply as is desired, the current is interrupted and at the same instant the electrode is moved outward so as to part from the tissues before cooling. If the whole lower turbinal is hypertrophied, the anterior third is cauterized first, and at intervals of about a week the contraction and consequent opening will be sufficient to admit of treating the middle and posterior thirds.

Unless the camphor-menthol treatment is used, swelling and sloughs occlude the passage until about the fourth or sixth day, when the sloughs separate. When the cauterization is extensive or deep, some considerable pain may be experienced for a number of hours, unless a pledget of cocainized cotton is left covering the surface. Occasionally a little pain is experienced in the upper incisors. If the septum is not hypertrophied the electrode should be kept away from it, and the burning is not carried deeply enough to include the periosteum. If suppuration is feared, glycozone may be substituted for the camphor-menthol.

Acute pharyngitis and ulcerative tonsillitis occasionally follow closely upon nasal cauterization, especially if the cauterization be quite extensive as to surface area or depth. The patient will be less likely to have pain, sneezing, and discharge from his nose after the operation if one or more coryza tablets be given. Although the writer has never seen grave consequences follow intranasal operations, it should not be forgotten that deaths have been attributed to them by Levy, Wagner, Quinlan, and others. Among the accidental effects reported are the following: Hæmorrhage, amaurosis, various manifestations of infection, meningitis, thrombosis of the longitudinal sinus, empyema of the maxillary antrum, hæmorrhagic and purulent nephritis, purulent inflammation of the joints, and several less serious conditions.

On the days following cauterizations the nose is sprayed with the antiseptic solutions already mentioned, and then by a 4-per-cent. solution of eucalyptol in lavolin, or the same strength of pine-needle oil, or benzoinol.

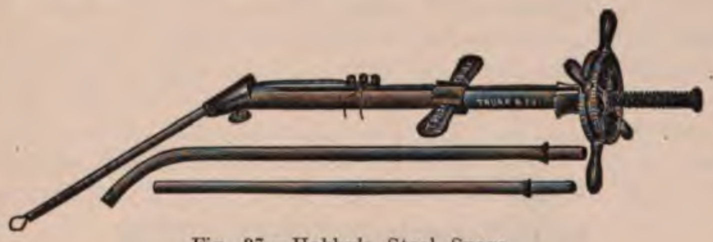


Fig. 37.—Hobby's Steel Snare.

For posterior hypertrophies Seiss prefers curettement. The snare (Fig. 37) is preferred by many specialists. It is introduced with the loop open, as shown in Fig. 36, and passed over the enlargement so as to engage it as near its base as possible, when, by drawing upon the wire or turning the wheel, the loop is made to sever the tissues. The Jarvis transfixing needle facilitates this manœuvre. The needle is passed through the hypertrophy until it projects beyond; the snare-loop is passed over both ends of the needle so as to lie on its under surface and to cut between the needle and the base of the growth. The cutting is done by a turn of the wheel at a time, taking from one-half to one hour for the operation. The more time, the less hæmorrhage. In removing posterior growths the rhinoscopic mirror is required, in order to view the field of operation (Fig. 8).

When deformities of the cartilaginous septum necessitate their removal, this is best accomplished by means of a specially fashioned knife having a tapering, blunt point (Fig. 38). After anæsthetizing, the hypertrophy is severed by entering the blunt probe-point of the knife below and cutting upward. In this manner the occlusion of the field by hæmorrhage is avoided if the cutting is done expeditiously.

Exostoses are sawed off in a like manner (Fig. 41). The motion of the saw should be rapid, and one should not bear so hard upon the handle as to make the saw catch and stick. With practice one can work rapidly with this instrument. The electric drill is a very efficient instrument and is manipulated like a dentist's drill (Fig. 39). The electric trephines afford a very effective and rapid means of removing cartilaginous and osseous growths from the septum nasi. Fig. 40 shows the exact size of two electric tubular saws, or trephines, the smaller of which is the one in common use in surgery of the nose and its connecting cavities. This instrument is capable of rendering excellent service where little work is to be done; but it has several serious faults which the writer has overcome in devising the larger trephine.

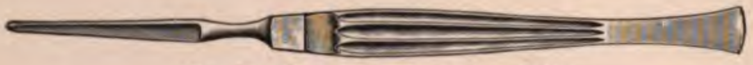


Fig. 38.—The Author's Septum-knife.

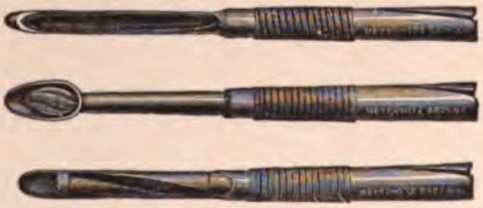


Fig. 39.—Electric Drills.

In removing a large and long spur from the nasal septum it is necessary to trephine through the centre of the spur; then above and below the centre in lines parallel with the first section, if the small trephine is employed. If the spur is longer than the tube of the trephine, the instrument ceases to cut as soon as it penetrates the distance of its own length, for the portion of the spur that enters the tube fails to pass out of the counter-opening as fast as it enters the tube, and it prevents the saw from entering farther. This necessitates withdrawing the trephine, removing the cut portion of the spur, and readjusting the trephine for proceeding with the cutting. Meanwhile the field of operation is likely to become covered with blood, and more time is lost in removing this in order to see what tissues one is attacking.

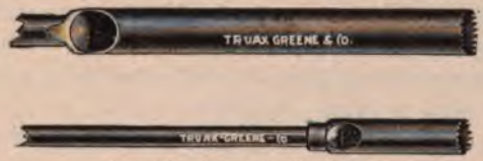


Fig. 40.—Electric Trephines.

The large trephine has a counter-opening as capacious as can be made without sacrificing the strength of the tube, so as to allow the contents to pass out as fast as they enter. It is much longer than the average spur, so that it would operate more satisfactorily than the small trephine, generally, even if the counter-opening were smaller. Its generous diameter renders it necessary to drive the instrument through the tissues fewer times in order to remove a given amount of growth.

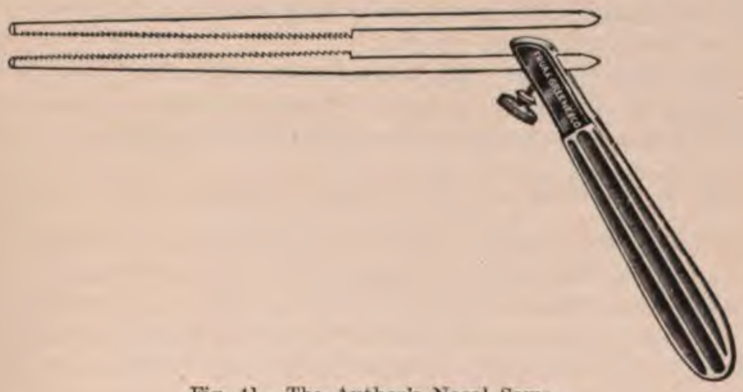


Fig. 41.—The Author's Nasal Saws.

In operating on the maxillary antrum the large trephine gives better results than the other. By passing the large instrument once into the antrum a canal of good size is obtained. Formerly I have passed the small one twice, and more times in some cases, before obtaining a sufficient opening for free drainage and efficient treatment. The large trephine is well adapted for opening the frontal sinus and the mastoid antrum.

In order to reduce the hæmorrhage to the minimum a saturated solution of suprarenal extract should be applied to the parts by means of cotton pledgets, and allowed to remain for ten minutes before using the cocaine. This contracts the blood-vessels and shrinks the tissues. Hence, less cocaine enters the circulation of the blood to produce toxæmia, the anæsthesia is more profound, and the bleeding is either prevented or greatly minimized.

Dudley S. Reynolds prefers adrenalin chloride. He says: "It is a powerful hæmostatic and acts promptly, generally within one minute from the time it is applied to mucous surfaces. Its effects persist from twenty minutes to four hours. It renders operations in the nasal passages and elsewhere nearly or quite bloodless, and does not predispose to secondary hæmorrhage, but has the contrary effect."

When the turbinate bone becomes enormously hypertrophied, turbinotomy is resorted to in order to remove the entire bone. This is accomplished with the saw or scissors (Fig. 45); but this operation is seldom necessary. William Scheppegrell and G. Melville Black (*The Laryngoscope*, November, 1897) have devised electromotor saws for operating in the nasal cavities.

Hygienic measures and internal treatment must be employed according to the indications and on general principles, and the matter of clothing is considered in the treatment of acute rhinitis.

The Nose and the Female Sexual Organs.

"A. Schiff has proved the observation of Fliess, that the pain of dysmenorrhœa was relieved promptly, in 34 out of 37 cases, by the application of a 20-per-cent. solution of cocaine to the 'genital spots' of the nose. Some cases he observed for months and he had over 200 positive results. Hypogastric pain was relieved by cocainizing the turbinal, and sacral pain by application to the tuberculum septi. By first contracting the tissues with suprarenal solution a 3- to 5-per-cent. solution of cocaine was sufficient to stop the pelvic pain. Of 13 negative cases, 4 had fixed retroflexion, 2 adnexal disease, and 1 had parametritis Two patients treated in Chrobak's clinic complained of hypogastric pain immediately upon application of the cocaine plug to the corresponding turbinal. In 17 cases the author cauterized the 'genital spots' during the menstrual interval with trichloracetic acid or electrolysis, with no return of the dysmenorrhœa in 12 cases, 1 being under observation from one and a half to two and a half years." ("American Year-book," 1902.)

ATROPHIC RHINITIS.

Synonyms.—Ozæna; fetid catarrh; cirrhotic rhinitis.

Pathology.—This form of nasal catarrh is a sequel of a pre-existing inflammation; indeed, it may be said to be the third stage of rhinitis in the logical order in which we have treated of the subject: (1) simple rhinitis, (2) hypertrophic rhinitis, and (3) atrophic rhinitis. In the latter variety there occurs an absorption and contraction of the newly formed connective tissue, obliteration of the venous sinuses, and atrophy of the mucous membrane. The turbinate bodies are reduced by this sclerotic process to less than their normal calibre, and the nasal cavities are correspondingly increased in size. The mucous glands participate in the general cirrhotic condition and exude less than the normal amount of secretion, which leaves the membrane dry; or the mucus becomes dried into scales or crusts, which ferment or decompose and emit a foul odor. The latter condition, ozæna, is not always present, and is probably dependent upon a strumous diathesis.

Etiology.—The real cause of atrophic rhinitis is veiled in obscurity. Although it undoubtedly follows a catarrhal condition of the mucous membrane involved, there are cases in which the disease appears to be one of an atrophic nature from the beginning. It is not rarely that we see it following hypertrophic rhinitis and even associated with it in the opposite nostril, and occasionally in the same side of the nose.

Loewenberg discovered in the crusts of ozæna a pathogenic cocco-bacillus and large bacilli in short chains, or in masses, appearing as diplococci. Hajek found a bacillus that he believed to be the cause of the odor and named it the "bacillus fœtidus ozænæ." While it is not likely that these bacilli give rise to the disease itself, they probably are the cause of the bad odor. The bacilli are not found in the mucous membrane, but in the secretions that form the decomposing crusts. Abel and Baurowicz also have found the Loewenberg bacillus.

Symptomatology.—In most cases of atrophic rhinitis the nasal membrane is of a very pale color and is dry in appearance. The lumen of the passages is enormously increased, so that one can see through to the throat and even to the orifices of the Eustachian tubes in rare cases. One or more of the turbinals may remain somewhat hypertrophied, indicating the previous condition, while the others are shrunken into miniatures of the normal bodies. On account of the enlargement of the cavities the patient is unable to bring sufficient air-pressure to bear to dislodge the drying secretions, and they are permitted to stick fast until decomposition renders them fetid and indescribably odoriferous. In this form, or ozæna, smell is lost—a beneficent provision—and taste is impaired, and sometimes the hearing also. A muco-purulent discharge is often found in such cases, and this, drying into crusts, presents a green or dark-brown color.

Diagnosis.—This is not difficult, for the appearance of the parts in the simple atrophy, and a smell of the sickening, disgusting fetor of ozæna are distinctly characteristic. Suppuration of the accessory cavities is generally unilateral. In syphilis necrotic bone may be detached with the probe, or the bridge may become depressed and the septum eroded away.

Prognosis.—As this disease is usually found between puberty and the thirty-fifth year, it may be expected to disappear in time of itself; but its disgusting character in about 50 per cent. of the cases, as much as its possible deleterious effect on the patient's general health, calls for persistent treatment. This must be measured by months, and it may take a year or more to eradicate the ozæna; but this can be done.

Treatment.—In the simple, dry, non-odorous atrophy stimulating applications, like a 4-per-cent. solution of iodine in benzoinol, fumes of resublimed iodine crystals from the inflator (Fig. 134), and gentle massage of the parts with the smooth probe will increase the circulation and nutrition. Vibratory massage is practiced as follows: After softening the crusts by the various sprays cotton is twisted thickly on the long applicator and carried to the site of each crust. Sufficient friction is then employed to dislodge and remove the scabs. Fresh cotton swabs are carried into the nasal cavities and used in this way until the mucous membrane is entirely cleaned and free from discharges. Then these cotton balls are used to gently beat and stroke the tissues, with care not to denude the membrane of its epithelium. To avoid the latter it is well to anoint the cotton with some stimulating oil, like benzoinol. The massage is practiced for about five minutes at a time over all the atrophic tissues. The membrane is thus cleansed and sufficiently irritated to increase the circulation of blood and to stimulate the mucous glands to secretion. The stimulating effect of the massage can be augmented by following it with the application of iodine fumes or thymol, 3 grains to the ounce of oil.

When ulcerations of the nasal septum occur, C. C. Rice treats them by means of friction with cotton moistened with listerin, rubbing several ulcerations rather forcibly and for a few seconds at a time. C. H. Knight prefers menthol to any other local remedy, but recommends borolyptol and ichthyol also. (*The Laryngoscope*, May, 1900.)

Dionisio, Braun, Chiari, and Laker (*Journal of Laryngology*, 1894) advocate intranasal vibratory massage by stroking and vibration with hand or electric cotton-covered probes.

For the ozæna hydrozone and washes of an alkaline, antiseptic character must be copiously used to free the cavities of all decomposing masses. The nasal douche so often advised is mentioned only to be condemned, on account of the liability of damaging the Eustachian tubes and ears and even the cavities accessory to the nose. Seiler's solution is excellent, and should be thrown in a coarse spray until the crusts are loosened and expelled, leaving a free, clean membrane to receive the curative medicaments. Listerin, pasteurin, glycothymolin, and micrazotol are good detergents. The latter contains boroglyceride, eucalyptol, thymol, resorcin, menthol, and benzoic acid.

The patient should be given the wash to use morning and night, after which he should spray the nostrils and throat thoroughly with a 3-per-cent. solution of camphor-menthol in lavolin. Two or three times a week the surgeon, after cleansing the cavities, should spray them with such remedies as carbolic acid and iodine in benzoinol (4 per cent.), and then dust the membrane all over with aristol powder (Fig. 144). When the odor is very foul the powder application should be preceded by a spray of a 10-per-cent. solution of camphor-menthol in lavolin.

John North informs me that he obtains the most satisfactory results from touching the atrophic area, after removing the crusts, with a solution of permanganate of potassium, 30 grains to the ounce of water. In a few weeks the scabs disappear and cease to form.

Tonic and alterative constitutional treatment and hygienic measures must be resorted to on general principles.

CHAPTER VI.

DISEASES OF THE NASAL CAVITIES *(Continued).*

EPISTAXIS.

Synonyms.—Nose-bleeding; nasal hæmorrhage; hæmorrhagia narium.

General Considerations.—Bleeding from the nose may have its origin in the nasal cavities proper or in the adjoining sinuses. It is frequent in childhood, occasional in old age, and rare in middle life.

Pathology.—The bleeding-point is most often found on the side of the septum, near the floor, and adjacent to the opening of the nose. Vessels may, however, rupture in any part of the membrane, or the hæmorrhage may proceed from one of the accessory cavities. Probably the bleeding occurs most frequently from ulceration of the membrane, by means of which the blood-vessels are penetrated by an extension of the erosion to their walls. This process perforates the septum; crusts form on the ulcerating parts, and upon their removal a raw, bleeding surface remains.

Etiology.—Falls and blows, the bad habit of picking the nose, foreign bodies, fractures, vicarious hæmorrhage, purpura hæmorrhagica, etc., cause nasal hæmorrhages.

Symptomatology.—Bleeding may come on without any premonitory symptoms, and even during sleep. The blood usually trickles from one nostril, a drop at a time, but sometimes runs in a stream. Only a slight amount is lost ordinarily, but it may amount to an alarming quantity and may even prove fatal. Frequent hæmorrhages tend to produce anæmia and demand corrective measures.

Diagnosis.—The condition is usually made out without difficulty.

Prognosis.—This is ordinarily good, but in old age it may be indicative of degeneration of the walls of the blood-vessels. In low fevers and diphtheria it is an ominous symptom.

Treatment.—The most common means adopted to check bleeding from the nose is to keep the head upright and compress the nostrils with the thumb and forefinger, or apply cold to the nose or the back of the head and spine. Hot water is recommended by some to be applied to the nose or injected into the bleeding nostril. The icebag (Fig. 194) is a convenient means of using continuous cold. Pulverized alum and tannin are useful. The latter is used in powder or, as mentioned later, in connection with tampons. A 10-per-cent. solution of cocaine on a cotton pledget packed firmly between the bleeding-point and the opposite wall is effective.

It is sometimes difficult, even with good reflected light, to locate the source of hæmorrhage, but this should be accomplished if possible. Antipyrin in 3-per-cent. watery solution or in powder and the liquor ferri perchloridi are useful. Some writers speak highly of the electrocautery, but the author cannot indorse it for this purpose.

Suprarenal extract, in a fresh saturated solution, is the most effective astringent we possess. Pledgets of cotton or gauze should be saturated with it and packed against the bleeding surface and allowed to remain for twenty-four hours. At the expiration of this time it must be removed, otherwise it will decompose and emit a very foul odor.

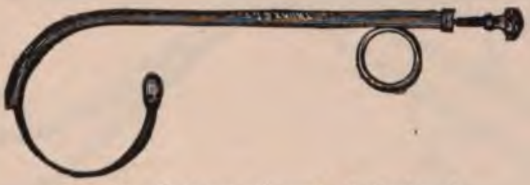


Fig. 42.—Bellocq's Cannula Introduced.

"Lewis A. Somers, to control persistent bleeding from the septum, had adrenal solution applied over the bleeding area at infrequent intervals for several weeks. The patient had had almost daily or nightly epistaxis for several months. There was intense congestion of the right side of the septum, with enlarged vessels, though they did not appear angiomatous nor was there a history of hæmophilia. The septum became pale and the vessels contracted to their normal size after the treatment, and the bleeding has not recurred." ("American Year-book," 1902.)

If the simpler measures fail, resort must be had to tampons. The following method is most efficacious: A long strip of lint, linen, or cotton cloth, three-eighths of an inch (one centimetre) wide, is immersed in a saturated solution of tannic acid in water, and then the water is pressed out, leaving the cloth thoroughly medicated. One end of this is carried by the delicate angular forceps or probe as far into the nose as the case requires. Then the remainder of the tampon is packed in, a small loop at a time, until it is pressed firmly into all the sinuosities, and the cavity is completely filled. Any surplus of the strip is then cut off.

Should tamponing of the anterior naris fail, posterior plugging must be added to it. In this case the posterior nares must be plugged first, as follows: Bellocq's cannula (Fig. 42) is threaded through the eye in the end of the spring with a strong string. The thumb-screw is adjusted so that it will throw the spring out after its introduction, as shown in the cut. Then the sound is introduced like the Eustachian catheter until the distal extremity projects downward over the velum palati. At this moment the spring is extruded until it, with the string, is seen through the open mouth. With hook or forceps one end of the string is brought out of the mouth and a pledget of cotton or lint as large as an adult's thumb is tied firmly to it. This is drawn backward and upward through the mouth and throat into the posterior nares. It should be made to plug effectually both posterior nares, for otherwise hæmorrhage might continue through the free one. In passing the tampon behind the palate, the finger should be introduced to prevent drawing the palate upward with the cotton. Then the finger can pack the tampon well into the nares. The string protruding from the anterior naris is fastened back of the ear with adhesive plaster. In hot weather this must be watched, or the perspiration will loosen it and allow the tampon to become displaced or swallowed. After a day or two the packing must be removed to prevent septicæmia. In the absence of Bellocq's cannula the Eustachian catheter can be substituted, and the writer has succeeded with a silver male catheter in an emergency.

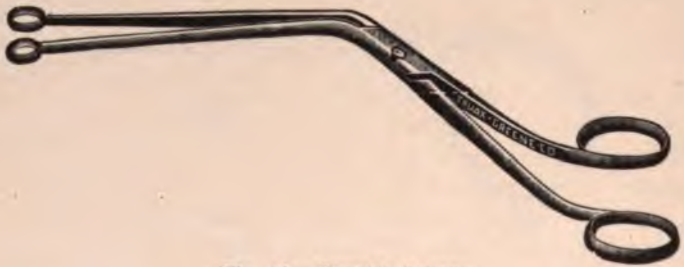


Fig. 43.—Curette-forceps.

Constitutional treatment may be required,—iron, ergot, etc.

NASAL POLYPI.

There are three varieties of benign neoplasms to which the term "nasal polypi" is applied: mucous, fibrous, and cystic.

MUCOUS POLYPI.

These occur in multiple form, and sometimes they are very numerous (Plate II). They are a pale-pink or ashy-gray color, and are most troublesome in damp weather, when they absorb moisture, causing them to swell and occupy increased space. They are usually found in middle life, from 20 to 40 years, and occasion stenosis of the nares and mouth-breathing (Fig. 71). The mucoid variety is the most common. Patients often observe movements in these polypi, which are occasioned by forcible currents of air in sniffing or blowing the nose.

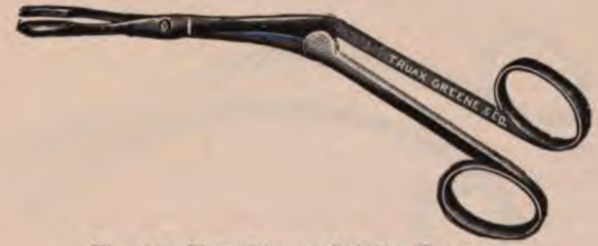


Fig. 44.—Very Strong Cutting Forceps.

They are generally attached either to the middle turbinal or to the outer wall of the middle meatus. (See "Treatment," below.)

FIBROUS POLYPI.

This variety presents a single, dense, resisting surface to the probe. It may develop into so large a mass as to invade the nasopharynx (Plate IV) or project from the nostril. It causes stenosis and supra-orbital headache, and its expansion causes pressure and deflection of the septum, as well as absorption of the turbinals. Necrosis of the bones and invasion of the adjacent sinuses may occur. The nose in some cases is bulged outward at the sides, which gives the arch a flattened appearance. (See "Treatment," below.)

CYSTIC POLYPI.

These are very rare, and consist of a cyst or sac filled with a yellowish or bloody, serous fluid.

TREATMENT.

Polypi should be removed preferably with the cold-wire snare (Fig. 37). The loop of the snare is introduced expanded, as seen in the electric snare (Fig. 36), and made to embrace the pear-like tumor and to slide up to its attachment. The polypus is then slowly cut off and the point of attachment is cauterized with the electrocautery or chromic acid to prevent a return of the growth. This is preferable to removal with the forceps or scissors, and if the evulsion is not too rapidly accomplished little hæmorrhage ensues. The biting curette-forceps (Figs. 43 and 44) are especially serviceable for searching out and removing the mere buds of polypi in the upper nasal passages. The writer often severs these growths with the electrocautery, which sears the seat of attachment and renders the operation bloodless. After-treatment is the same as after removal of hypertrophies, already given.

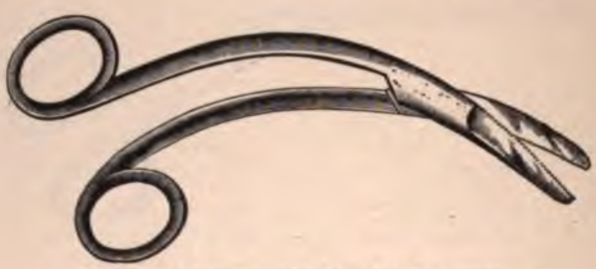


Fig. 45.—Casselberry's Saw-tooth Scissors.

PAPILLOMATA.

These are benign neoplasms of infrequent occurrence. They may be single or multiple, and are most often attached to the lower part of the septum or inferior turbinal. (See "Treatment" under "Erectile Tumors.")

ERECTILE TUMORS.

These are very rare. They have the appearance of an hypertrophy of the turbinate body, except that pulsation can be detected in them. This is in consequence of their close relationship to an artery, and their removal is likely to be attended with considerable hæmorrhage.

Treatment consists in removal of the growths either by chemical or mechanical means. Chromic acid or the galvanocautery may suffice, or the nasal scissors (Fig. 45) may prove preferable.

CHONDROMATA.

Cartilaginous tumors are rare growths occurring about the age of puberty and springing from the septal cartilage. Their location, unyielding firmness, and sessile shape distinguish them from fibromata. The color is a light pink, and they have not the smooth surface of fibrous tumors, but are indented by numerous depressions.

Treatment.—If these growths prove troublesome they should be removed. Many methods are in use,—the knife, saw, chisels, punch, dental or electric drills and trephines, the electrocautery, etc.

The cartilaginous growth is easily removed, under cocaine or eucaine, by the author's septum-knife (Fig. 38). The cutting should be done as already described, and care should be taken not to perforate the septum. It is claimed by some rhinologists that healing does not take place so readily after the electrocautery as after cutting, but the author has not been able to confirm this opinion.

OSTEOMATA.

The bony tumors also are very rare. They are offshoots from the mucous membrane and the product of an osseous degeneration of connective tissue. Their pressure produces headache, asthenopia, occasional hæmorrhages, and ulceration with a purulent discharge. Unlike rhinoliths, they resist a needle and do not crumble. (See "Treatment" under "Exostoses.")

EXOSTOSES.

Osseous growths are frequently met with in the nose. They usually take the form of ridges or spurs upon the bony septum, encroaching upon the lumen of the passage sometimes to a considerable extent. Occasionally the growth attains to very large proportions until pressure is produced on the opposite turbinal or adhesion to it occurs, forming a synechia or bridge across the canal. Figs. 25, 26, and 57 show such conditions. In Fig. 25 the probe is inserted to the point of adhesion between the exostosis and the inferior turbinate bone. The contour of the latter will be seen in Fig. 26 to have been altered by the pressure, from a convexity, like the opposite one, to a concavity. The septum is deflected toward the exostosis.

These growths arise from the periosteum and may occasion no inconvenience if no pressure is exerted on surrounding tissues, but when they impinge on the posterior portion of the inferior turbinal, reflex asthma may result. They are hard, immovable, light pink, and bleed easily on pressure with the probe (Plate III). They may cause headache, amblyopia, and other ocular disturbances.

Treatment.—Osteomata and exostoses should be removed when they have attained to such a size as to occasion symptoms of their presence. The former may be removed by the snare, strong saw-tooth scissors, curette, or forceps; the latter by the saw (Fig. 41). A strong solution of cocaine must be used, preferably 20 per cent. The electric trephine and drills are convenient for this purpose, and the dental motor also is effective. The writer generally employs the electric trephines and drills of various sizes (see Figs. 39 and 40).

Rhinoliths.

Synonyms.—Nasal calculi; calcareous concretions.

Pathology.—Rhinoliths consist of the salts of the nasal secretions deposited on some nucleus, such as a foreign body, necrosed bone, or a blood-clot. They are composed of calcium phosphate and carbonate, magnesium phosphate, sodium chloride, and small quantities of organic matter, such as mucin and proteid material. They vary in color, form, and size. Usually they are gray or brown. The rhinolith shown in Fig. 46 is greenish brown. The third and fourth large pieces in the top row are shaped like coral, although the perspective was not right to illustrate this feature in the central one. The photo-engraving shows the exact sizes of the fragments, all of which before removal constituted one rhinolith, the weight of which was seventy-one grains.

Symptomatology.—A rhinolith is, in effect, a foreign body and gives rise to both subjective and objective symptoms. Among the former are nasal irritation, headache, obstruction, and defective and perverted sense of smell. The objective symptoms are a serous, mucous, purulent, or bloody discharge from the nose, with a disagreeable odor in some cases, and impaired resonance of the voice. The septum has been found deflected sufficiently to hide the stone in several instances.

Diagnosis.—To illustrate the ease with which a rhinolith may be overlooked it is only necessary to mention that a number of physicians had examined the nasal cavity containing the large calculus shown in the accompanying figure without detecting its presence. As soon as the probe came in contact with it, the hard, gritty, characteristic sensation imparted by the stone was readily apparent. It was slightly movable, but its removal without being crushed was out of the question. The secretions so effectually disguise the nature of the obstruction that the careful use of the probe is necessary to a correct diagnosis. This calculus was located nearer the posterior than the anterior naris.

Prognosis.—Extraction of the stone and proper after-treatment insure a cure. Although the one shown in the engraving was removed in May, 1899, there has been no recurrence, and no trouble in that nasal fossa since.

Treatment. — Being substantially a foreign body, a rhinolith should be treated as such. If it is small enough to glide easily out of the nostril it can be extracted with forceps, a lever, or a bent probe. Cotton firmly twisted on a holder may be made to engage the prongs of the stone in its fibres, when traction may withdraw the calculus from its nest. The large one illustrated herewith required to be crushed before its removal by the natural channel was possible. It was found on the floor of the right nasal fossa of a woman 59 years old, who suffered from chronic rhinitis, and chronic non-suppurative inflammation of the middle ears, accompanied with intolerable itching in the auditory canals, and attacks of intense hyperæmia and heat of the left external auditory meatus and auricle.

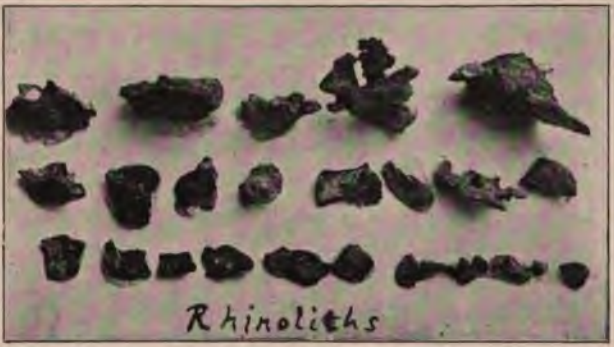


Fig. 46.—Fragments of a Rhinolith, Exact Size, Weighing Seventy-one Grains, from a Woman Fifty-nine Years Old. (Author's Case.)

Before attempting the extraction of these concretions the fossa should be cleansed, disinfected, treated to suprarenal extract to contract the tissues, and cocainized. The very large stones will demand powerful crushing forceps. Great care should be used to avoid injury to the mucosa and submucous tissues during the operation.

SARCOMATA OF THE NOSE.

These are, fortunately, rare occurrences. Sarcoma and carcinoma are sometimes developed in this region. Sarcoma does not differ in this locality from its characteristics in other situations. It is more likely to be found on the septum, but may invade the other nasal walls. It gives rise to pain, obstruction of respiration, fetid discharge, and possibly difficulty in swallowing and impaired hearing when it extends to the naso-pharynx. If it invade the nasal vault the cranial cavity may become involved, resulting in a fatal termination.

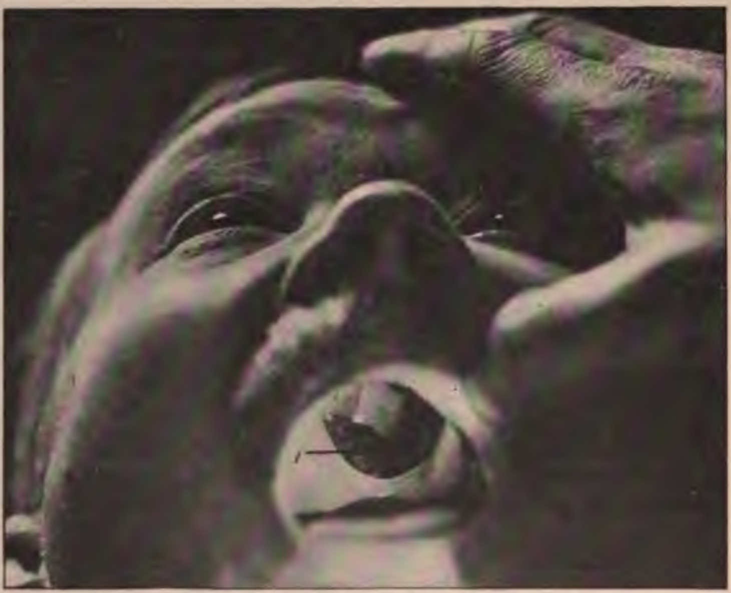


Fig. 47.—Destruction of the Hard Palate, the Soft Palate Remaining Unharmed. Through the very spacious perforation in the hard palate is seen a dark object with round and roughened surface: 1, a myaloid sarcoma.

Sarcomata are of rapid growth, and present a dark, roughened surface in some instances; in others they are pale. Fig. 47 shows a myaloid sarcoma springing from the inferior turbinated body of a syphilitic. I am indebted to the courtesy of E. Pynchon for a photograph of this case. As pressure develops laterally, bulging of the nasal walls becomes apparent in the contour of the nose and the prominence of the eyes. The gravity of the disease is manifested in a general constitutional disturbance. The probe causes bleeding and discovers a soft, fleshy mass. This is a rapidly fatal disease of less than a year's duration.

Treatment.—Complete extirpation is the only remedy. Anodyne and astringent applications after the disinfecting and cleansing washes are only palliatives.

CARCINOMA.

Cancer of the nasal passages differs in no way from the same disease elsewhere. An ulcerating surface with a brown, serous fluid, pain and hæmorrhage, infiltration of the cervical glands, and constitutional symptoms characterize this disease. The end is death.

Treatment.—There is no certain curative treatment. The growth may be somewhat retarded and the suffering ameliorated by anodyne and astringent applications. Cocaine and aristol are the best. Hasse and others report good results from interstitial injections of alcohol. Those are treated of under the heading of "Treatment" in "Carcinoma of the Pharynx."

The x-ray is claimed to exert a curative influence on cancer and lupus, but sufficient data upon which to base a positive opinion have not yet been obtainable.

CHAPTER VII.

DISEASES OF THE NASAL CAVITIES *(Concluded).*

TUBERCULOSIS OF THE NOSE.

FORTUNATELY this is a rare affection. It appears in two different forms: an ulceration and a neoplasm, or tumor. The ulcer appears on the septum near the orifice of the nostril, and may extend from this point to other parts of the nose and it may even invade the upper lip. It is more likely to be secondary to tuberculous affections of other organs than a primary manifestation. The ulcer appears as a yellow or gray surface with a round, elevated, uneven border. There is a purulent discharge, more or less tinged with blood, and of a disagreeable odor. There is no tendency toward cicatrization, and after being once healed it has a strong disposition to break out again. Pain is not a common symptom. Sooner or later the disease, which is now generally conceded to be due to the bacillus tuberculosis, invades the larynx and lungs and terminates in death.

In eight cases of tubercular tumors of the nose seen by Shäffer, all were located on the cartilaginous portion of the septum. These granular neoplasms presented as nodules, some of them attaining to the size of walnuts, and were pale pink or red. After the removal of these soft masses the perichondrium was found to be involved, and became ulcerated, with the result of causing perforations of the septum. It may not be possible to find tubercle bacilli, or only a few may be detected.

The writer has observed cases exhibiting the typical symptoms, and pursuing the well-known course, of tuberculosis even unto death, in which the many examinations of various bacteriologists utterly failed to discover a tubercle bacillus.

Tubercular ulcers are more likely to appear on the cartilaginous section of the septum than on the osseous segment, but they have occurred on the turbinals.

Treatment.—Cleansing, antiseptic solutions, such as are noted in Chapter I, must be freely used. Curettement, the electrocautery, chromic or lactic acid,—the latter in 50-per-cent. strength,—may be resorted to for the removal of the caseous, tuberculous material that forms the base of the ulcer. In case of a tumor, it should be removed with the snare and the attachment-surface should be cauterized. Astringents and iodoform are useful in retarding disintegration and the invasion of adjacent structures. If pain is present, morphine, cocaine, or eucaine may afford temporary relief. Codliver-oil should be given, and guaiacol in doses of 1 to 10 minims after each meal. This is best administered in glycerin, milk-broths, or wine. Creasote is often useful. For other remedies consult the sections on "Tuberculosis of the Pharynx" and "Tuberculosis of the Larynx."

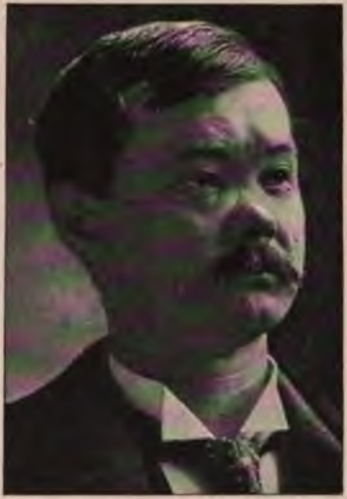


Fig. 48.—Destruction of the Bones Forming and Supporting the Bridge of the Nose.

SYPHILIS OF THE NOSE.

The manifestations of syphilis in the nose correspond to the three stages of syphilis occurring in other organs. It may be hereditary or acquired. In the former it appears either before the third month of childlife or between the third year and the beginning of adolescence. In infants the affection simulates coryza, but tends strongly toward suppuration. The discharge is more acrid and irritating than that of simple rhinitis, and produces a red and raw appearance of the upper lip. The borders of the nostrils are cracked and chapped. Nasal respiration is embarrassed, and, in consequence of the interference with sucking, the babe is ill nourished and puny. If the disease attack the cartilage or bone, an offensive odor is imparted to the discharge.

The later form of hereditary syphilis presents manifestations of the tertiary form. It attacks the cartilaginous and osseous septum and then the turbinate bodies, and by carious and necrotic processes they undergo more or less complete destruction. The supports to the end and bridge of the nose disappear and the end may drop down toward the upper lip, or, if it remain supported by a remnant of the cartilaginous septum, the centre of the bridge may cave in and produce the exaggerated pug-nose deformity (Figs. 48 and 49).

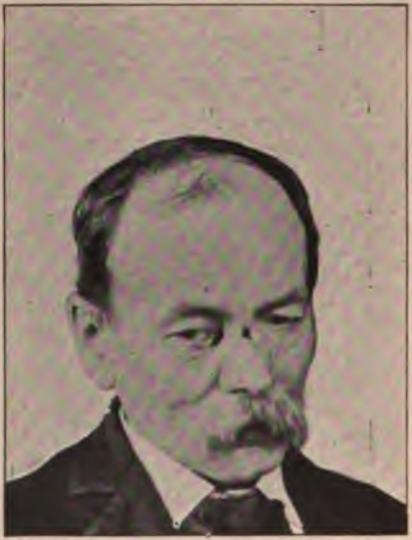


Fig. 49.—Partial Destruction of the Bones of the Nose, Resulting in Two Perforations: One in the Centre of the Bridge and Another at the Inner Angle of the Right Eye. (From the Author's Clinic.)

Diagnosis.—With care one will be able to distinguish the obstinate, persistent, pus-producing rhinitis of a syphilitic infant from an ordinary cold in the head which in an uninfected child tends toward speedy resolution. Mucous patches may be discernible in the nares and a papular eruption on the skin. These children are often badly nourished, old looking, and unpromising. After taking into account all the characteristics mentioned, if in the later form there exist any doubt as to the nature of the disease, a course of antisyphilitic treatment will dispel the uncertainty.

Prognosis. — If the pathological process has not involved the cartilaginous or bony walls, and if the patient is not greatly debilitated, the chances of recovery are good.

Treatment.—Cleanliness and specific medication are often rewarded by brilliant results. The antiseptic sprays given in Chapter I are indicated, after which tincture of iodine applied to the ulcerating surfaces will be followed by healthy granulations and cicatrization. If the ulcers do not cicatrize promptly, it is advantageous to dust the parts with aristol or nosophen (Fig. 144) after the cleansing process. We generally use the mixed treatment,—small doses of mercury with potassium iodide. The latter may have to be given in increasing doses until the system is saturated. This treatment, vigorously pursued and carefully watched, gives gratifying results.

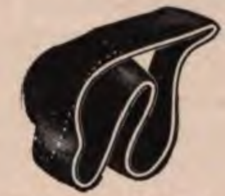


Fig. 50.—The Author's Nasal Supporter.

In great debility and malnutrition codliver-oil, malt, tonics, and improved sanitary surroundings may be necessary. When extensive deformity of the nose takes place, it may become necessary to resort to a rhinoplastic operation to restore the contour and continuity of the organ. When the cartilaginous support of the end of the nose has been destroyed so as to let the tip fall upon the upper lip, the author has restored the natural lines by a device shown in Fig. 50, which he has named a "nasal supporter." It is fashioned to fit into the tip of the nose, so that the sides or wings of the supporter will correspond to the alæ nasi. It is so placed as not to be visible when in position. They were first constructed of aluminium, but the bright, reflecting surface was observable. Later I experimented with vulcanized rubber, and found that, after making the surface a dull black, it answered all requirements. The improvement in the facial appearance after restoring the pendulous nose to its normal position is something to be appreciated.

Destruction of the major portion of the septum nasi does not necessarily result in external deformity. The writer has under observation such cases in which there is no external discoverable evidence of the internal architectural desolation.

Lupus of the Nose.

Lupus affecting the nasal cavities is a rare affection except as an extension of primary lupus of the face or pharynx. The nodules—which are found more abundantly on the septum than on the turbinals—break down, ulcerate, and discharge a foul-smelling, purulent secretion. In and about the prominent border of the ulcer can be seen the hard, but resilient, tumefactions, or nodules. As the discharges dry upon the ulcers, brown or greenish crusts form, offering more or less obstruction to the nasal respiration. Pain, radiating to the surrounding structures, is complained of, and the ulcer is sensitive to touch. This is easily differentiated from ozæna.

Treatment.—In addition to the detergent and antiseptic sprays mentioned in treating of ozæna, etc., the treatment is the same as that given for lupus of the ear.

Glanders.

Glanders is a disease derived from the horse and is encountered among horse-farriers, coachmen, etc. It is due to a specific contagion and manifests its presence by the formation of pustules which give way to ulcers of the skin. It attacks the nose and throat, from which a bloody pus is discharged in large quantities. Constitutional symptoms characteristic of a serious systemic invasion or toxæmia indicate the gravity of the disease. When the infection extends to the lymphatic glands and skin in various parts of the body it is termed "farcy."

This disease is either acute or chronic. The acute form is ushered in by symptoms similar to those of the eruptive fevers: chills, nausea, vomiting, fever, and red rash on the nose and face resembling erysipelas. This is followed by the appearance of blisters, which burst and leave their contents on the skin to dry into crusts. On removing these an ulcerating surface is disclosed that shows no inclination to heal, but rather to extend over the surrounding parts. The pustular eruption invades the nose and throat, causing embarrassment of respiration. The copious, tenacious discharges from the nose and throat, and sometimes from the eyes, keep the patient occupied freeing the passages. In the chronic variety the secretion is not so copious, and it may be lacking, except in the desiccated form of scabs on the nasal and pharyngeal membrane.

Symptoms suggestive of tuberculosis come on later: colliquative diarrhœa and sweats, huskiness of the voice, and difficulty of deglutition and respiration from tumefaction of the mucous membrane of the pharynx and about the glottis. Great prostration and delirium precede death.

The diagnosis may be obscured by the many symptoms that are characteristic of other affections, such as typhoid fever, rheumatism, syphilis, pyæmia, etc., but the history of the patient, exposure to infection from horses, and lack of further pathognomonic symptoms of other diseases must be considered. As distinguished from typhoid, we have the pronounced nose, throat, and skin eruptions and discharges and ulcerations; from articular rheumatism, pains in the muscles and tenderness surrounding the joints; from syphilis, the constitutional disturbance and absence of proving by specific remedies; from pyæmia, even when abscesses are found there is little or no chilliness.

The acute form is rapidly fatal, lasting only about a week, while the chronic variety may persist for several months or a year. About half of all the cases die.

Treatment.—No antitoxin has yet been evolved that acts as a specific for this disease. From the nature of the case it is to be expected that such a remedy will yet be found. No treatment so far tried has a decided influence in curing or retarding the progress of this virulent affection. It must be left to the practitioner to meet symptoms and indications as they arise and appeal to his knowledge of the general principles of medicine.

FURUNCULOSIS OF THE NOSE.

Boils in the nose are a common source of discomfort. They occur repeatedly in some individuals and cause soreness, redness, and swelling of the end of the nose, lasting about a week. Small furuncles often develop just within the opening of the nostril, especially on the upper border, and originate in a hair-follicle. They render blowing and wiping of the nose very painful.

Treatment consists in local and constitutional remedies. To the boil situated within the border of the naris a pledget of cotton may be applied after moistening it with a 10-per-cent. solution of camphor-menthol in lavolin or benzoinol, or a 12-per-cent. solution of carbolic acid in glycerin may be substituted, as recommended in the treatment of furuncle of the ear. When pus is found it is evacuated, giving an opportunity for the remedies to enter the cavity. This treatment should be followed by the application of the yellow-oxide-of-mercury ointment, 5 grains to the ounce in vaselin, or the carbolic-acid ointment. Sulphide of calcium has a reputation of repressing or preventing pus formation, and can be given in those cases in which recurring crops of furuncles torment the patient. The author has used with satisfactory results arsenious acid in doses of $^1/_{30}$ grain three times a day, increasing gradually to two or three times that quantity for a short time, until the patient was free from these symptoms, and, if they reappeared after a few months, repeating the treatment with larger doses continued for a longer time. This treatment has been successful in breaking up what appeared to be an established habit of body in which furuncles broke out with every spring opening.

ANOSMIA.

Absence or loss of the sense of smell may be due to central lesion or peripheral diseases. Affections of the Schneiderian membrane may destroy the nerve-termini or offer such obstructions as to render them inaccessible to odors. Acute inflammation of this membrane and suppuration of the adjacent cavities, such as the frontal sinuses, that cause the membrane to become bathed in purulent discharges, and syphilis and atrophic rhinitis, ozæna, etc.,—that produce destruction of the membrane,—cause, on the one hand, temporary impairment or absence of the function of the olfactory nerve, and, on the other, irreparable loss of smell.

Blows in the region of the olfactory bulb, and occasionally in other parts of the skull, cause injuries to the bulb from which it does not recover. Excessive tobacco-smoking, snuff-taking, and opium-using either blunt or obliterate the sensibilities of the olfactory nerve. The sense of taste generally suffers more or less in all these instances.

Treatment.—Anosmia due to acute inflammation of the nasal and connecting cavities generally disappears when the cause of it is removed. The appropriate treatment then is the same as for the inflammation that produces it. When the loss of smell has existed for several years the outlook for its restoration is not encouraging.

Yet the writer has seen a partial return after the whole mucous lining of the nasal cavities had gone through a protracted siege of ulceration in consequence of an irregular physician spraying the cavities with a corroding fluid by mistake, resulting in a complete loss of the sense. To complicate the case there was syphilitic infection. In such cases the treatment detailed for syphilis of the nose and ozæna is appropriate. Absolute cleanliness and nerve-tonics, such as strychnia and the faradic current, are indicated. The negative electrode is placed over the root of the nose and the positive on the occiput, both electrodes being saturated with salt water.

PAROSMIA.

In parosmia the sense of olfaction is perverted. This happens even where the sense is normal for all objective odors. Various subjective odors are complained of, all disagreeable, such as oils, carrion, kerosene, etc. A physician under my care was annoyed by a constant subjective odor of "greasy rags or soap-grease." This symptom may be due to disease of the nasal mucous membrane, the decomposition of retained nasal secretions, disease of the olfactory nerve, or cerebral lesion and overstimulation of the nerve. As an example of the latter cause: I have treated a gentleman who for many years has been engaged in the perfume business, and during that time has gradually lost his sense of smell without any apparent causative lesion in the nasal cavities. Perverted olfactory function has been observed in the insane and epileptics.

Treatment.—If the nasal membrane is diseased and if hypertrophies, polypi, etc., are present to account for increased, retained, and perverted secretions, suitable treatment, such as has already been discussed for these conditions, may remove the disgusting symptom, but if the cause lie in the nerve or its origin, or exist in the imagination as an hallucination, the indications for treatment are not so plain. If the olfactory bulb is the seat of the disease, galvanization or faradization, as mentioned for anosmia, may prove beneficial.

DEFORMITIES AND DISEASES OF THE NASAL SEPTUM.

Exostoses, ecchondromata, and synechiæ have already been considered and are illustrated by Figs. 25 and 26 and Plate III. It is unusual to find a nose with an interior that is architecturally symmetrical. The septum in many instances is either curved (Figs. 51 to

57), thickened, or even doubly curved so as to present a sigmoid flexure or a corrugated appearance. If the deformity is not sufficient to produce pressure on the turbinate bodies and consequent irritation, epistaxis, and obstruction to nasal respiration (Plate III), no symptoms referable to the anomaly are present. According to Zuckerkandl, the septum is not found deviated before the seventh year, but the author has under observation a boy 5 years and 9 months of age with deflection, spurs on both sides, hypertrophied turbinals, and adenoids. The causes of malformed septa are not known, but the theories are many. O. B. Douglas believes that "traumatism is a more frequent cause than all the others combined. Pressure at birth is doubtless a cause in certain cases" (*The Laryngoscope*, March, 1898). J. W. Gleitsmann attributes deflections of the septum nasi to the pressure upon the septum from below by the abnormally high arch of the roof of the mouth, occasioned by mouth-breathing in consequence of adenoid vegetations in the vault of the pharynx. The deflection may be so exaggerated as to give a twisted or bent appearance to the whole nose. The irregularity is limited generally to the anterior and middle sections of the septum.

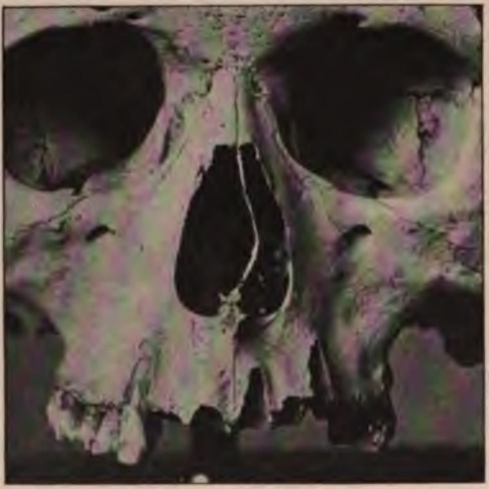


Fig. 51.—Moderate Deflection of the Septum Nasi. The deflection generally involves more or less of the cartilaginous portion of the septum and may extend to its anterior, free border. In the latter case the lumen of the anterior naris is diminished, and the breathing space is seriously encroached upon.

Symptoms of nasal irritation—epistaxis, discharges, reflex neurosis (such as asthma), nasal voice, naso-pharyngeal catarrh, etc.—result from considerable septal deformities. The diagnosis is readily made on inspection with brilliant, reflected illumination.

Treatment.—If the deformity is limited to the cartilaginous septum the most satisfactory procedure in my experience has been the amputation of the offending projection by means of the septum-knife (Fig. 38). The method is described in connection with the figure. We have always taken pains to avoid perforating the septum, but we have seen many cases in which surgeons had made large apertures without any unpleasant consequences. When the bony partition is involved the saw or trephines are called for. Various punches have been constructed to fracture and restore the deviated septum, after which bougies (Fig. 24), splints, and tampons are employed to maintain the reduced deformity in proper position.

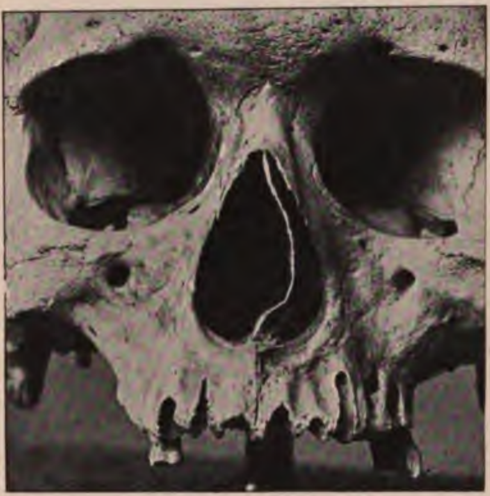


Fig. 52.—Deflection of the Septum Nasi Sufficient to Cause Stenosis of the Left Nostril; Capacious Right Naris at the Expense of the Left Nostril. In this condition pressure of the septum on the turbinals may cause sufficient reflex irritation to provoke asthma, hay fever, ocular disturbances, and other reflex neurasthenic symptoms.

C. G. Coakley prefers the operation devised by Morris J. Asch for correcting deviations of the nasal septum. Special instruments for this purpose are required as follow: Straight and angular scissors, compression forceps, elevator, gouge, and tubular splints. One uses the scissors first to cut the cartilage along the line of greatest deviation, and, second, to bisect the first incision at a right angle to its centre. Then the index finger is used to force each resulting segment into the nasal median line, fracturing each quadrant at its attached base. The forceps are used to straighten any deviation posterior to the site of the operation. A large, hollow splint is inserted into the formerly obstructed fossa, and is worn for four or five weeks, being removed frequently for necessary cleansing. The elevator and gouge are employed to divide adhesions. Emil Mayer has reported two hundred cases of the Asch operation "all of them permanently benefited."

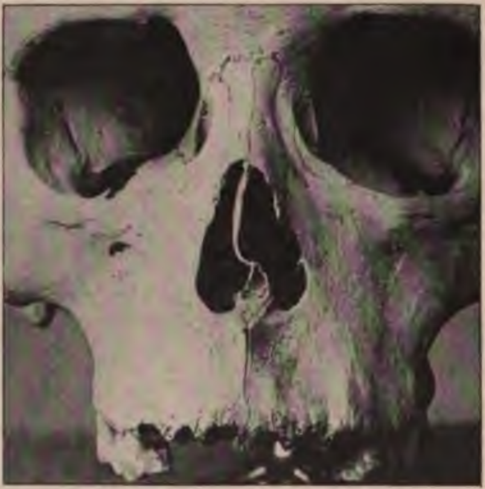


Fig. 53.—Deflection of the Septum Nasi Toward the Right Side, at Nearly a Right Angle. Such deformities are characteristic results of fractures of the osseous septum by falls or blows upon the nose, particularly in childhood. The pressure on the opposing turbinals results in their atrophy, while the opposite turbinated bodies are often found hypertrophied.

The writer has made use of the same principle in correcting deformed nasal septa, with the most satisfactory results. Gleason and others have devised useful operations.

J. Price-Brown employs silver tubes to correct septal convexities. "The advantage of silver tubes lies in their lightness, aseptic character, smooth surface, and the fact that a silversmith can form one to suit each case. The open tube enables the patient to breathe through it. A small bulge on its outer wall will insure its retention, and the patient soon learns to remove and cleanse it and replace it daily. ("Diseases of the Nose and Throat," 1900.)

BLOOD-TUMORS OF THE NASAL SEPTUM.

Hæmorrhage from blows, etc., takes place between the mucous membrane and the cartilage. Fractures of the septum occasionally result in hæmatomata. These tumors are easily recognized and should be opened before their contents degenerate into a purulent mass, resulting in abscesses. (See "Treatment" under "Abscess," below.)

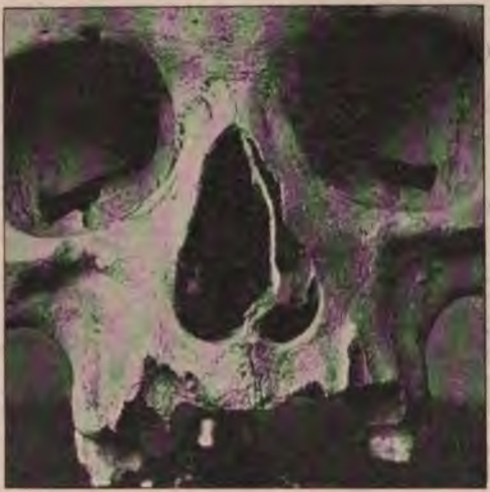


Fig. 54.—Deflection of the Septum Nasi Toward the Left Side with Apparent, but not Real, Adhesion to the Left Inferior Turbinated Bone. Such deformities extending throughout the cartilaginous portion of the septum are accountable for the tilting of the tip of the nose to one side of the median line, producing the crooked-nose deformity.

ABSCESS OF THE NASAL SEPTUM.

Like blood-tumors, abscesses are generally in the cartilaginous portion of the septum. They may assume such proportions as to completely blockade the nostrils and compel mouth-breathing. In a case recently under my care the swellings were symmetrical and had attained such a size as to protrude sufficiently from the nostrils to be plainly visible. They are usually the result of blows, and their history and appearance render the diagnosis easy.

Treatment.—Abscesses of the septum, like blood-tumors, should be opened, their contents evacuated, and the cavities cleansed with hydrozone. Then equal parts of alcohol and tincture of iodine should be injected so as to wash out the cavity. The dressing is completed by packing aristol gauze between the opposite wall and the septum so as to cause coaptation of the separated mucous membrane to the cartilage again. This method may prevent perforation of the cartilage, which is a frequent sequel of these diseases.

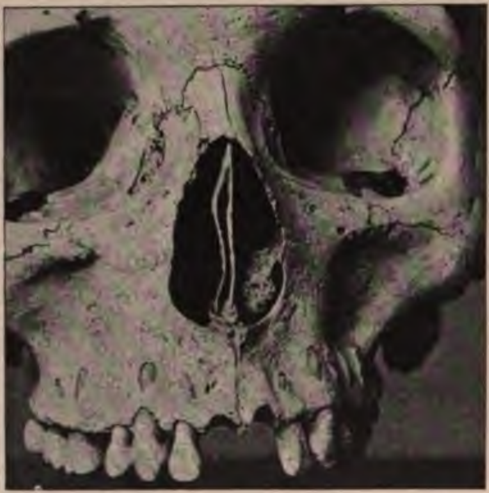


Fig. 55.—Perpendicular Portion of the Ethmoid Bone, Consisting of Two Plates; the Inferior Turbinated Bone of the Left Side is Plainly Visible.

PERFORATION OF THE NASAL SEPTUM.

An aperture is not infrequently found in the cartilaginous part of the septum when patients are unaware of its presence (see Plate II), but occasionally a small perforation causes a whistling sound as the current of air moves rapidly over it, annoying the patient and attracting the attention of others. A prominent educator of my acquaintance was troubled in this manner. He was apparently in excellent health and there was no assignable cause for the anomaly. Perforations are usually considered as indicative of syphilis, but they are not necessarily so. We have often been unable to trace them to any specific taint. They may occur as the result of impaired nutrition or the habit of picking the nose with the fingers. Abrasions are produced, and the crusts that form over them are not allowed to remain until healing occurs beneath. In the course of exhausting diseases, such as tuberculosis and typhoid pneumonia, the septum may become perforated.

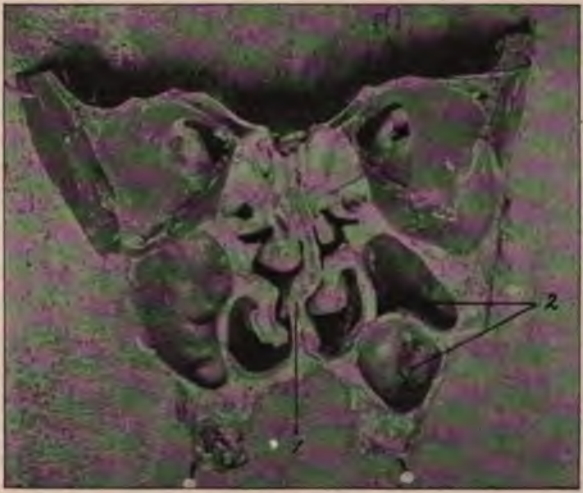


Fig. 56.—Transverse Vertical Section through the Nasal Fossæ. 1, Deflected septum nasi in contact with the left inferior turbinated body. Its deflection toward the left side has caused atrophy of the left middle turbinal, and has permitted an hypertrophy of the right middle turbinal. 2, Two maxillary antra of the left side, while there is only a single one on the right side.

Treatment.—Unless the perforation causes a whistling sound perceptible to others or annoying to the patient, no treatment is required except the application of benzoinol or some stimulating ointment to the border of the perforation. Treatment does not result in its closure. If disagreeable sounds are produced the opening can be changed in shape so that its long axis shall correspond to the air-current.

In operations on the nose Delavan (*Journal of Laryngology*, 1895) deprecates perforating the vomer on account of the disproportionate shock resulting. French (*New York Medical Journal*, December 1, 1894) perforates the septum when necessary for breathing-space, but insists on proper after-treatment, and Wright insists on thorough antiseptic treatment before and after operations on the nose.

FRACTURES OF THE NOSE.

The bones of the nose are not easily or often broken. The arched contour and the cartilaginous portion serve to protect against such accidents. A blow or fall upon the nose sideways, however, may drive the bones inward and produce deformity, or a powerful force, like the kick of a horse, may shatter the osseous arch. The deformity produced by such accidents is shocking. The sense of smell is likely to be destroyed on account of the damage done to the olfactory nerves. Examination under ether will reveal the nature and extent of the injury, which is readily apparent. The fact that such accidents are liable to produce concussion of the brain should not be lost sight of in forming a prognosis.

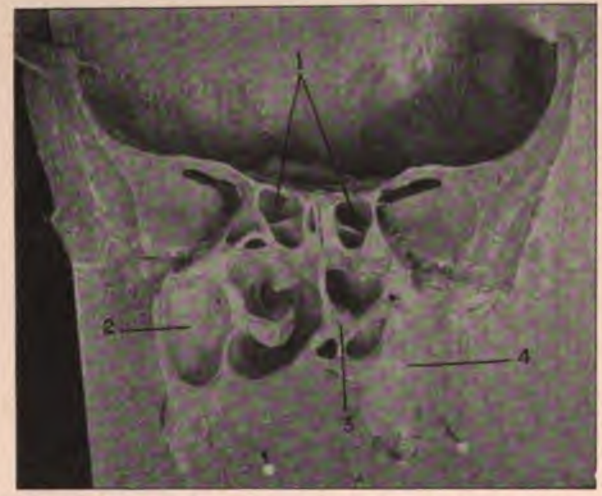


Fig. 57.—Transverse Vertical Section through the Nasal Cavities. 1, Ethmoid cells. 2, Right maxillary antrum. 3, Deflected septum, and spur with adhesions (synechiæ) to the inferior turbinal and to the floor of the meatus. 4, The maxillary antrum should be above this line, but it is absent.

Treatment.—Pain, bleeding, œdema, swelling, and emphysema of the tissues demand immediate attention to check the hæmorrhage, relieve the pain, and reduce the swelling. Anodynes and the icebag (Fig. 194) meet these requirements. Then the fractures must be reduced to as perfect coaptation of the parts as possible, since nasal deformity, above all others, influences the business and social interests of the patient. The pure-silver Eustachian catheter can be bent to the proper shape and inserted beneath the depressed bones to elevate them to their correct level, while the fingers of one hand support them from without and assist in nicely adjusting them. If restored to their normal relations they remain so, since there is no muscular contraction to again displace them. Union usually takes place rapidly.

Congenital Deformities of the Nose.

These are exceedingly infrequent occurrences. If a deformity consist of an impervious membrane of the posterior nares it must be perforated to establish nasal respiration.

Deformities which involve a depressed condition of the nasal arch may be so far corrected as to convert an unsightly member into a comely form. This is accomplished by Gersuny's method of injecting paraffin under the skin covering the saddle-back deviation from the normal lines. With an Eckstein syringe the paraffin is introduced at a temperature varying from 108° to 115° F., preferably at 111° F. Then the raised portion of the skin is molded into the proper contour over this body of paraffin, which sets, and sustains the superimposed integument in the form desired.

Foreign Bodies in the Nose.

The nose, like the ear, is a favorite receptacle for foreign bodies introduced by children and the insane. Beans, peas, pebbles, etc., are not infrequently found lodged in these cavities. The act of vomiting occasionally forces the ejected matter into the post-nasal space. Bodies inserted into the nostrils are generally located near the vestibule in the inferior meatus and are readily seen on inspection. Sneezing, lacrymation, nasal obstruction and discharges are the symptoms that point toward the invader. Berries so absorb the serum and swell that their increased calibre and the tumefaction of the mucous membrane occlude the offended nostril. Unless the body is removed it provokes inflammation and ulceration, with frontal and facial neuralgia and a purulent discharge more or less discolored with blood. The inflammatory process may extend backward to the post-nasal space and to the opposite nostril, compelling oral respiration and causing loss of smell, and impairment of hearing from involvement of the Eustachian tube. Decomposition of the retained secretions causes a fetid odor and the occasional expulsion of cheese-like masses.

If the obstructing body has been crowded or snuffed backward into the middle portion of the meatus, it may be shielded from view by the swelled turbinal or by a covering of the discharges. The secretions should be soaked up by the careful application of absorbent cotton on the carrier. This is better than to syringe or spray the nose, for there is less liability of forcing the body farther out of reach. After drying the cavity a 10-per-cent. solution of cocaine is applied to the tumefied turbinal, so as to contract it and afford a view of the whole interior of the cavity. Suprarenal extract will serve the same purpose. The probe will then detect any alien substance.

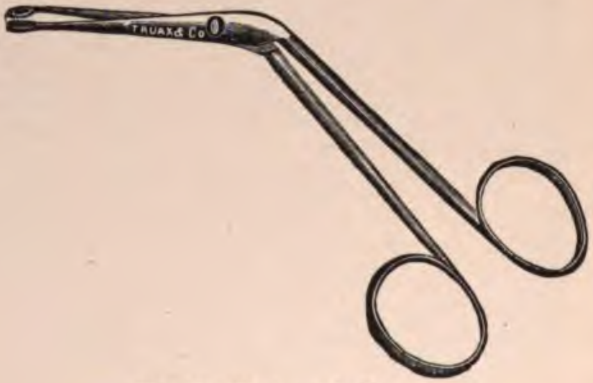


Fig. 58.—Hartmann's Forceps.

Treatment.—Foreign bodies should be removed as early as possible to prevent serious consequences. This can generally be accomplished by angular forceps (Fig. 58). They should be applied with care not to crowd the body farther inward. It is best not to close the jaws of the instrument until one is certain that it embraces the body a little beyond its centre, otherwise it is likely to slip off, and in doing so propel the body still farther from view. In the case of a berry of a plant, like the bean, that has become softened and enlarged by the absorption of moisture, a sharp hook like the one found in the author's middle-ear case (Fig. 181) can be made to imbed itself in the substance of the body and glide it out of the canal. In some instances a blunt hook, the snare, and mouse-tooth forceps offer decided advantages.

Maggots in the Nose.

This is a condition rarely found except in tropical climates. The eggs of flies are deposited in or about the nares, maggots are hatched, and destruction of the soft tissues and even of the nasal bones ensues. M. A. Goldstein reported having removed over 300 larvæ from the nose of a patient who had been infected by a blow-fly (*The Laryngoscope,* December, 1897). Itching, crawling, gnawing sensations and intense pain are experienced. A bloody, purulent discharge of fetid character appears. The intense inflammation may invade the surrounding structures, causing redness and œdema of the face and meningitis, with convulsions, coma, and death.

Diagnosis.—Inspection readily reveals the cause of the trouble.

Treatment.—Chloroform is the most efficient remedy. Inhalation may be sufficient to destroy the larvæ; if not, it should be injected into the nose after enough has been inhaled to prevent pain. This is made to syringe out all the maggots and effectually empty the cavities. William Scheppegrell found that oil freely sprayed into the nostrils killed the larvæ (*The Laryngoscope,* February, 1898). After-treatment should be attended to according to the condition present until the health of the membrane is restored.

CHAPTER VIII.

DISEASES OF THE ACCESSORY CAVITIES OF THE NOSE.

Inflammation of the Antrum of Highmore, or Maxillary Sinus.

This disease occurs sometimes as a complication of acute rhinitis, and if severe is accompanied by a sense of uneasiness or pain and tenderness in the antral, orbital, and frontal regions. These symptoms are more common when there is obstruction to the outward flow of the secretions. If the disease does not subside coincidently with the subsidence of the rhinitis, a chronic suppuration results, or empyema. It may arise as a sequel to diseases of the teeth, especially the first and second molars, or in connection with the eruptive fevers and syphilis (see Fig. 65).

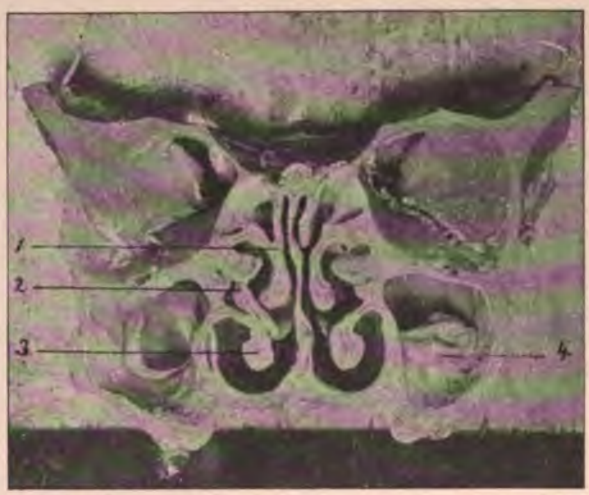


Fig. 59.—Transverse Vertical Section through the Nasal Fossæ and Maxillary Antra. 1, Superior turbinated body united to the middle turbinal. 2, Polypoid growth from the shelving outer wall of the fossa. 3, Inferior turbinated body. 4, Tumor in the maxillary antrum.

This affection is generally unilateral. Examination reveals a purulent discharge in the middle nasal meatus and its foul odor is noticed by the patient, showing the difference between this and ozæna, in which the sense of smell is destroyed. Empyema of long standing affects the general health to such a degree that a constitutional disturbance is readily apparent, and tumors sometimes develop (Figs. 59 and 60).

Diagnosis.—This is facilitated by the use of suprarenal extract or cocaine in the nose to contract the turbinals. If a rhythmic pulsation is seen in the pus lying in the middle meatus, antral suppuration is suggested. The pus should be removed and observation made to determine if it reappear from the antral cavity, issuing from below the middle turbinal. Pressure over the maxillary sinus or tapping upon a tooth may reveal tenderness. If hydrogen dioxide (peroxide) can be injected into the antrum through the opening beneath the middle turbinal, the usual effervescence will disclose the presence of pus, and is likely to cause pain. In exploring the antrum some operators prefer to enter the cavity through the socket of a tooth, which may

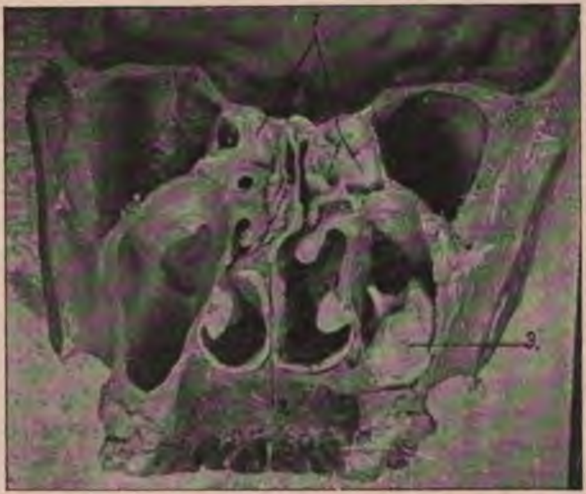


Fig. 60.—Transverse Vertical Section of the Nasal Fossæ. 1, Ethmoid cells. 2, Deflection and spur of the nasal septum, probably the result of a fracture separating the two plates of which this bone consisted; the consequent pressure on the left turbinals has caused their atrophic condition. 3, Tumor in the antrum of Highmore.

need to be sacrificed for this purpose, while others open the wall of the inferior meatus. Still others perforate the thinner wall of the middle meatus, under cocaine, going outward and downward to avoid the orbit. Then the author's aspirator (Fig. 179) may succeed in pumping the pus from the cavity. The patient is instructed to make a continuous effort, as in pronouncing the consonant part of *k*, so as to elevate the palate and close the post-nasal space. Then the air-pump is manipulated, to prove the presence of pus.

A purulent discharge from the antrum, when due to dental origin, is fetid; but when it is from other sources, like the ethmoid and frontal sinuses, it is creamy and almost without odor. (L. C. Cline, *Journal of the American Medical Association*, September 23, 1899.)

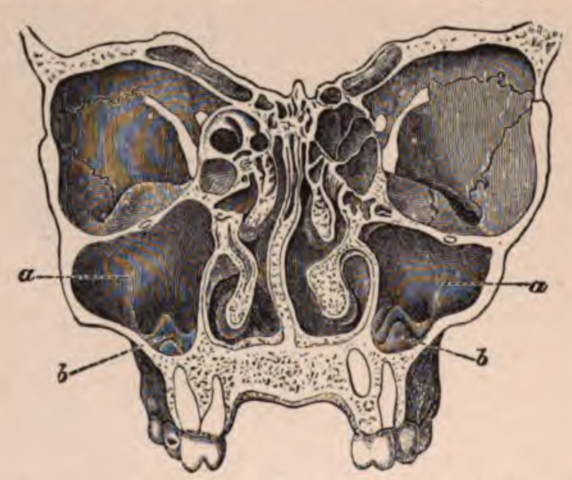


Fig. 61.—Transverse Vertical Section through the Maxillary Antra. *a*, *a*, Antra of Highmore. *b*, *b*, Very thin alveolar process, allowing the teeth to nearly penetrate the floor of the antra.

Prognosis. — This is not an inspiring one. The nature of the case is unfavorable for spontaneous resolution, and if the bone is necrotic a tedious time is to be expected. Otherwise the prognosis is good.

Treatment.—As a complication of acute rhinitis, the treatment for the latter is indicated. If the mouth of the sinus is closed it should be cleansed with the antiseptic sprays, mentioned in Chapter I, with diluted hydrozone, and then moistened with a cocaine solution to contract the tissues and open the hiatus. If there is much pus in the antrum or if it is inspissated, it is not an easy matter to evacuate and cleanse the sinus through the ostium maxillare. The opening is so small that it may be necessary to penetrate the bone. Some operators, like the late Moses Gunn, make a crucial incision in the cheek, and perforate through the canine fossa, but it is better to penetrate through the alveolus of a tooth, especially if it prove to be the exciting cause of the trouble (Figs. 61 and 62).

The weight of argument and experience is in favor of entering the sinus through the nose, just below the natural opening. The cannula and trochar (Fig. 63) are best adapted for this purpose, for the cannula can be left in position until the cavity is thoroughly cleansed and medicated. The after-treatment should be conducted similarly to the medicinal treatment detailed for middle-ear suppuration.

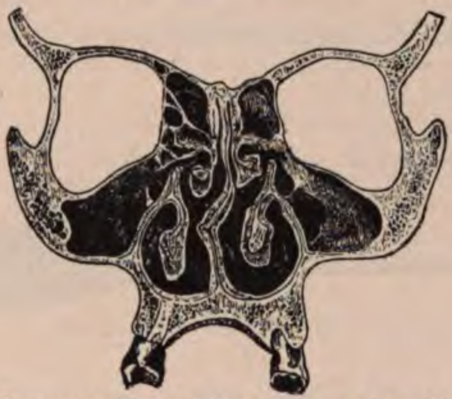


Fig. 62.—Transverse Vertical Section through the Maxillary Antra, showing on Either Side that an Operation to Open the Antrum through the Socket of a Tooth Would Result in Penetrating the Nasal Cavity Instead of the Antrum of Highmore.

The writer has devised a combination of cannula and spray-tips which render good service (Fig. 64). They are an adaptation of the Davidson or De Vilbiss atomizer fitted with spray-tips having very large openings, and the outer tip being turned to fit closely into the conical opening of a special cannula. The latter is made of silver, and is practically a modification of the Eustachian catheter. Instead of having the beak curved on the arc of a large circle, like that of the catheter, it is bent on the arc of a very small circle, so as to allow of its introduction into a narrow space. This arrangement of the beak is required for the purpose of introducing it into the maxillary antrum, either through the ostium maxillare or through an artificial perforation: for instance, the opening made by way of the socket of a tooth. The outer spray-tip is so nicely adjusted to the conical mouth of the cannula that there is no leaking at their junction, although the first ones made were defective in this respect; but a small piece of rubber tubing fitted over the outer spray-tip, to join it with the cannula, prevents the leaking. The inner spray-tip can be dispensed with.

When fluids are thrown through the cannula they escape from its beak in the form of a very profuse spray, which approaches the character of a stream in effect. It is so copious, in fact, that it deluges the cavity into which it is projected, and with an air-pressure of only eight pounds the full bottle of the detergent solution is emptied within a minute. The same tips, used without the cannula, are valuable for flushing the nasal fossæ.

By means of this antrum-spray some cases of suppuration of the antrum of Highmore can be cured without making an artificial opening; but the apparatus is just as effective for washing out the antrum after an operation. By rotating the beak of the cannula, introduced through the artificial opening, the walls of the cavity can be thoroughly cleansed and medicated, as I have demonstrated many times.

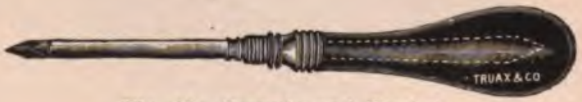


Fig. 63.—Cannula and Trochar.

If the cannula is to be used in the ostium maxillare, the opening of the antrum is first located, the cannula is introduced, and the latter is then marked at the point corresponding to the tip of the nose. This mark, in any given case, facilitates the introduction of the cannula afterward.

The same apparatus is useful in treating suppurative inflammation of the ethmoid cells, the beak of the cannula being directed upward so as to throw the coarse spray into the cells. Some patients with disease of the frontal sinuses have claimed that they could feel the spray from the cannula enter the sinuses. I have not felt certain, however, that they were not mistaken. This instrument has proven to be effective, also, in washing out cholesteatomatous masses from the attic of the tympanic cavity.

After cleansing the suppurating surfaces, various powders—such as boric acid, aristol, and nosophen—are blown through the cannula to the diseased parts. When used as an attachment to the powder-blower the cannula must be dry; hence it is advisable to have more than one for use in the combined wet and dry treatments.

Miscellaneous.—Phlegmonous inflammation of the antrum is a very rapidly fatal form of inflammation.

Tumors of the antrum are exceedingly rare, but require extirpation through the anterior wall. (See Figs. 59 and 60.)

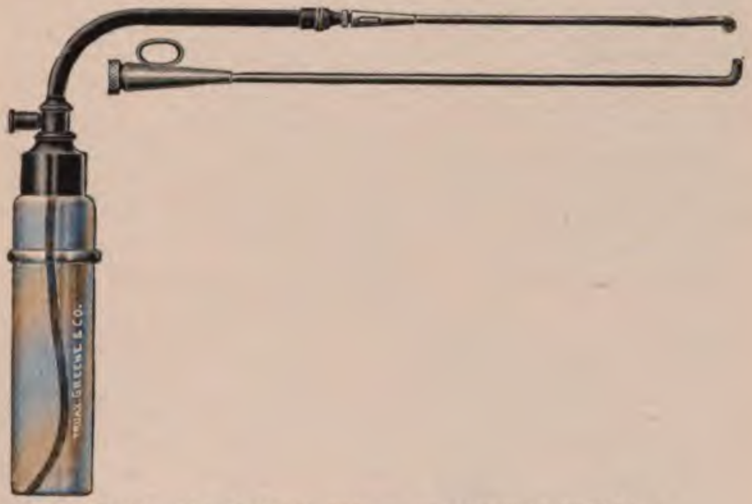


Fig. 64.—The Author's Antrum and Ethmoid Irrigator.

ETHMOID DISEASE.

An inflammation of the nasal membrane sometimes extends into the ethmoid cells (Fig. 65), the membrane of which, like that of the mastoid cells, lines the osseous cavities and serves as a periosteum. Hence an inflammation of this membrane is readily communicated to the bony walls themselves, resulting in caries and necrosis. Pain is referred to the root of the nose and the orbital and temporal regions. The disease may extend so as to produce a bulging prominence between the eye and the root of the nose, and the eyeball may protrude abnormally. In a girl of 17 years, in bad general health (Fig. 71), the arch of the nasal bones was widened, the vault of the nose was filled with mucous polypi, and the flow of the muco-purulent discharge was enormous, necessitating the carrying about of a bundle of cloths instead of a handkerchief. There were also adenoids in the vault of the pharynx, hypertrophied tonsils, and chronic suppuration of both middle ears. The polypi, adenoids, and tonsils were removed, but the polypi were reproduced with mushroom-like rapidity. The ethmoid cells were opened up and curetted, and she improved satisfactorily. The discharges from the ethmoid cells and ears ceased.

Diagnosis.—The antrum of Highmore is often involved coincidently, and it is sometimes difficult to make a differential diagnosis between the two. However, the pain in ethmoiditis is referred to the root of the nose and back of the eye, and the eye symptoms help to clear up the uncertainty. The discharge is generally seen where it occurs in antral suppuration, but the smell, in this disease, is more likely to be impaired or lost.

Prognosis.—When ethmoiditis is a simple concomitant of acute rhinitis it subsides together with the principal disease. Suppuration is a serious condition, for it may invade the orbit or extend to the cerebral meninges.

Treatment.—Antiseptic, detergent washes already given in the first chapter—consisting of hydrozone, etc.—must be employed for cleansing purposes. All polypi should be removed and then I make use of the curettes shown in Fig. 201 to scrape out carious and necrotic tissue. If the middle turbinate body is too large to admit of proper observation and manipulation, it must be removed, as already described. The anterior ethmoid cells are in communication with this turbinal; hence the advantage of its excision. After-treatment is the same as for antral suppuration. (See description of Fig. 64.)

Polypi sometimes take their origin from the ethmoid cells, producing pressure on the surrounding structures. The result is apparent, especially in the increased breadth of the nose and the prominence of the eyes (Fig. 71). Osteomata produce like appearances. The treatment for growths in this locality consists in extirpation. (See "Treatment" of "Nasal Polypi.")

SPHENOID DISEASE.

It may be observed that I have departed from the custom of adding "al" to the adjectives ethmoid and sphenoid. This is because it is etymologically correct to do so; it is in keeping with the American tendency to brevity and terseness, and in conformity with the common use of the corresponding term "mastoid" instead of "mastoidal."

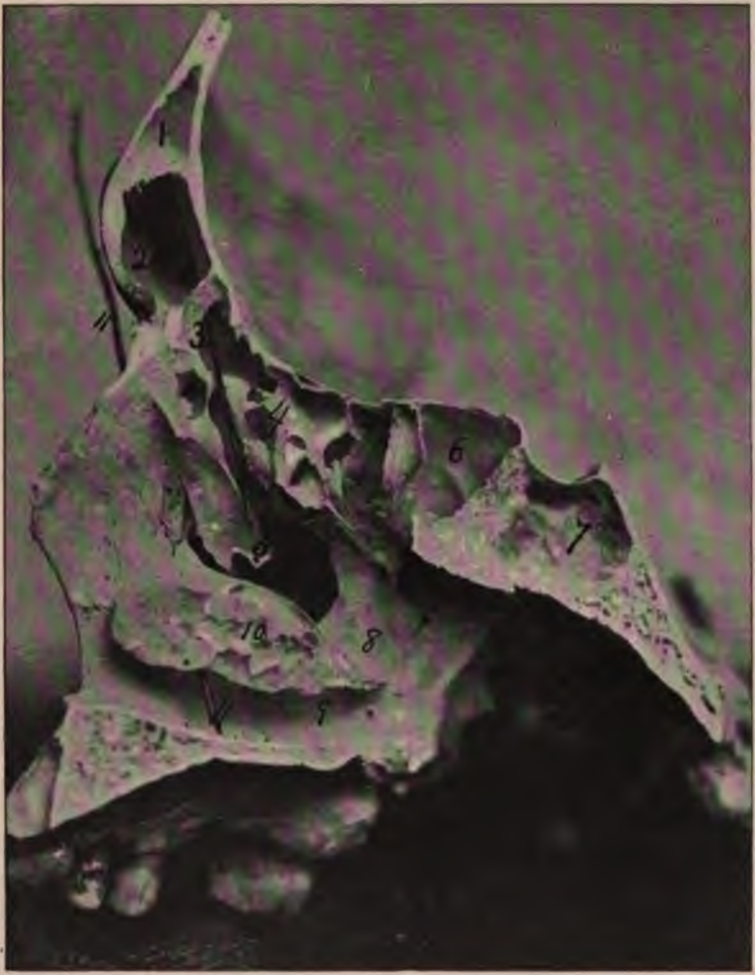


Fig. 65.—Longitudinal Vertical Section (Actual Size) through the Nasal and Accessory Cavities. (Author's Specimen.) 1, Right termination of the left frontal sinus. 2, Right frontal sinus. 3, Probe extending from the right frontal sinus through the infundibulum into the right nasal fossa. 4, Ethmoid cells. 5, Large opening into the maxillary sinus. 6, Anterior antrum of the sphenoid bone. 7, Posterior sphenoid antrum. 8, Middle nasal meatus. 9, Inferior meatus. 10, Inferior turbinated bone. 11, Probe extending through the nasal duct.

These terms are Greek adjectives merely transferred into English, and are not rendered more perfect by additional terminations.

Sphenoiditis occurs as a complication or sequel of inflammation of the nasal accessory cavities (Fig. 65) and of meningitis. The symptoms are not pathognomonic and this affection is difficult to differentiate from disease of the ethmoid cells. The pain is deeply seated, the discharge empties into the throat, and dimness of vision, strabismus, and prominence of the eyeball are symptoms characteristic of this disease.

The throat-mirror may reveal pus escaping from the sphenoid antrum into the naso-pharyngeal cavity. Schaeffer, of Bremen, has reported a large number of these cases, and gives the symptoms of the chronic cases as follow: Fetor, dizziness, supra-orbital neuralgia, stiff neck, or general pressure of the head or occiput. The pain is intermittent and may produce nausea and vomiting. He never found eye trouble. (Oscar Dodd, in *The Laryngoscope*, May, 1901.)

The prognosis is unfavorable on account of the tendency to invade the cranial cavity (Fig. 66).

Treatment.—The methods already described for diseases of the accessory cavities are applicable here. If it should become necessary to open and curette the sphenoid sinus (Figs. 65 and 66), the instrument should be passed over the middle turbinal, backward and upward, until it enters the lower part of the cavity. The sinus can be opened through its under wall also by perforating through the pharyngeal vault immediately back of the posterior nares. Subsequent treatment has been indicated in treating of the other sinuses (Fig. 64).

Tumors are rare in the sphenoid sinuses, but if they produce blindness or other serious symptoms they must be removed.

DISEASES OF THE FRONTAL SINUSES.

Inflammation of these cavities (Figs. 65 and 66) occurs mostly from extension of rhinitis. It is not to be expected under the twentieth year, since these sinuses, being developed from the anterior ethmoid cells, are not formed earlier. Acute inflammation is characterized by a severe, continuous, frontal headache and pain about the eyes. There is tenderness over the sinuses on percussion, and on pressure beneath the supra-orbital ridge. Nausea and vomiting are occasionally present. The pain may not be due entirely to the swelling of the mucous membrane lining the cavities, but to the loss of the natural air-pressure, for I have observed that the propelling of air impregnated with a nebula of camphor-menthol into the sinuses gave decided relief.

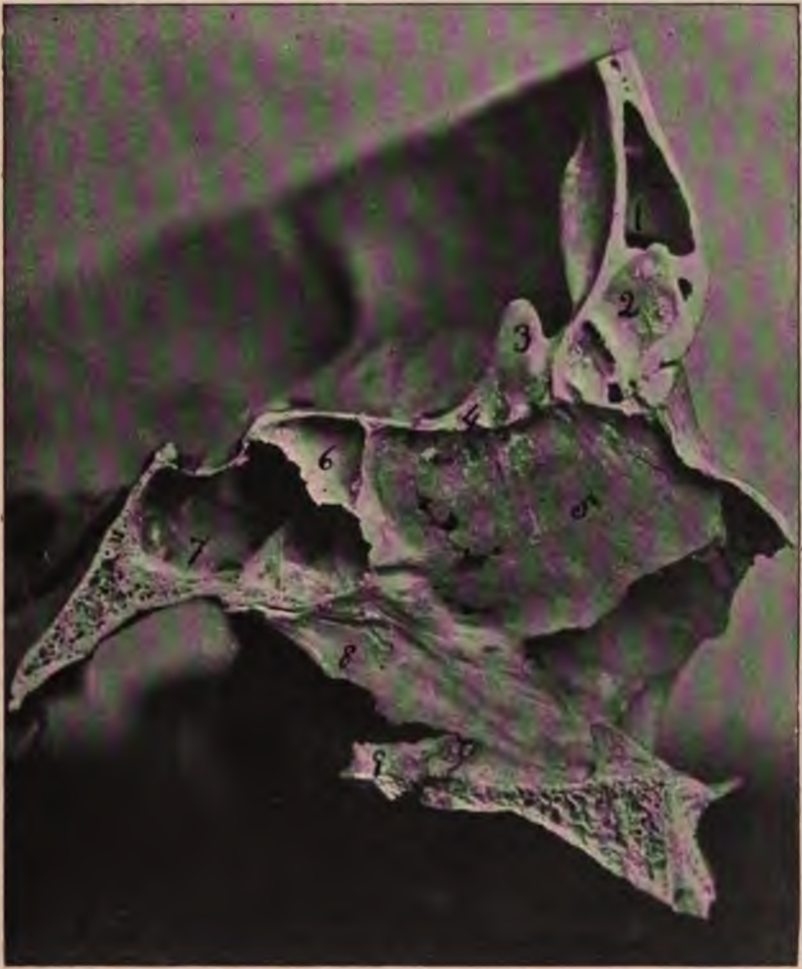


Fig. 66.—Longitudinal Vertical Section (Natural Size) through the Nasal and Accessory Cavities. (Author's Specimen.) 1, Left frontal sinus. 2, Termination of the right frontal sinus. 3, Crista galli. 4, Cribriform plate of the ethmoid bone. 5, Perpendicular plate of the ethmoid. 6, Part of the anterior sphenoid antrum. 7, Posterior sphenoid antrum. 8, Vomer. 9, Palate bone.

When the infundibulum, or passage between the nasal and frontal cavities (Fig. 65), becomes clogged, the retained secretions, mucus or pus, will cause great pain. The pressure may be sufficient to cause absorption of the osseous partition separating these sinuses, or bulging may take place downward and outward so as to encroach and press upon the eyeball.

Suppuration of the frontal sinuses is an infrequent disease. The pus can be seen in the middle meatus under good illumination, flowing downward from the region of the sinus-opening. It should be wiped away and the area watched to see the source of the discharge. If the pus break through the posterior wall of the sinus, there are symptoms of brain-compression, drowsiness, headache, stupefaction, etc. This complication induces purulent meningitis.

The symptoms point quite distinctly to the seat of the trouble, and are not so obscure as in sphenoiditis. The electric lamp and condenser of Heryng are useful in making diagnoses in this class of diseases. Transillumination of the frontal sinus is accomplished by applying the lamp to the lower border of the supra-orbital ridge and inner angle of the orbit in a dark room. In health the sinus is illuminated up to the superciliary ridge, but in case of the presence of pus it is dark.

Treatment.—The first indication is to subdue the pain. If the inflammation occur in the course of acute rhinitis the treatment for that is appropriate and effective here. An application of suprarenal extract or cocaine to the sinus-opening may so contract the swollen tissues as to open the duct, give exit to the pent-up secretions, and relieve the pain. The detergent, antiseptic sprays given in Chapter I are useful in this affection. After cleansing the cavities by sprays and having the patient repeatedly blow his nose, great relief is afforded by throwing a nebula of a 10-per-cent. solution of camphor-menthol in lavolin or benzoinol into the nostrils, with the air-current directed toward the naso-frontal duct. This tends to evacuate any retained secretions and to restore the normal air-pressure in the sinuses, besides medicating the remote membrane as ordinary treatment fails to accomplish. (See description of Fig. 64.)

In the acute stage an icebag (Fig. 194) is indicated to subdue and avert the inflammation. It should be applied over the frontal protuberances and the root of the nose. If this should not afford relief, or if it prove irritating, hot fomentations may be substituted. Any obstructing hypertrophies or tumors must be removed, as previously described. If the discharge contained in the sinuses cannot be liberated by opening the naso-frontal duct with air-pressure, cocaine, or a probe, it may be necessary to penetrate the sinus directly, near the internal angle of the orbit, at which point the cortex is quite thin.

This procedure is similar to that which has already been detailed for opening the mastoid antrum and removing the diseased contents.

"Trephines and drills are preferred by some surgeons, but the simplicity and ease of the manipulations of chisel, gouge, and mallet entitle these instruments to the preference." (Robert Sattler.) Tumors of the frontal sinuses are treated on the principles already laid down for tumors of the other accessory cavities.

CHAPTER IX.

RELATED DISEASES OF THE EYE AND NOSE.

For many years it has been recognized that diseases of the eye and of the nose were often associated and interdependent. In certain cases pathological conditions originate in the nose and extend, by continuity of tissue or by migration of morbific germs, to the eye. Occasionally the reverse process occurs. More recently reflex ocular disturbances arising from nasal affections have received attention.

When one considers the close relationship existing between the eye and the nose and its adjoining cavities, it is not surprising that morbid conditions of these parts are closely related. The mucous membrane of the eyeball and lids is continuous with that lining the lacrymal sac, the nasal duct, and the nasal and connecting cavities (Fig. 67). The eye is in close proximity to these cavities, and the blood- and nerve- supplies of the nose and eyes are intimately connected with each other. The nasal duct is the drainage-canal of the eye, through which the surplus moisture of the latter is emptied into the nose. Hence, organisms inhabiting the nose or its accessory sinuses and antra may migrate through the nasal duct to the eye (Fig. 68), and, conversely, disease-germs that lodge in the eye may pass through the lacrymal sac and the nasal duct to the nasal fossa, there to set up their pathological processes.

In health there is a free communication between the nose and the eye; so much so that inflation of the nasal cavities may cause the air to pass through the nasal duct, the lacrymal sac, and canaliculi to the eye. Indeed, the author remembers to have seen the loose areolar tissue about the eye, the side of the nose, and the upper part of the cheek made greatly emphysematous after a nasal inflation, due to rupture of the lacrymal sac. The swelling occasioned no inconvenience, and it subsided in a few hours. This case illustrates the ease with which morbific material may be propelled from the nasal cavity through the patulous nasal duct to the eye by the acts of sneezing and inflation of the nasal fossæ by the Valsalvan experiment and by blowing the nose. From this cause may originate inflammatory affections of the lids, cornea, or sclera.

In order to set forth fairly the present *status* of opinions on this subject among ophthalmologists we will refer to the experiences of several authors.

W. F. Mittendorf says: "Inflammatory conditions of the lining membrane of the nose are, perhaps, the most frequent of all the causes of inflammatory actions in the tear-passages. How often do we not see diseases of the conjunctiva or cornea, especially those that are accompanied by lacrymation, followed by inflammation of the Schneiderian membrane; and, on the other hand, mild forms of conjunctivitis generally accompany catarrhal inflammation of the nose or the tear-sac."

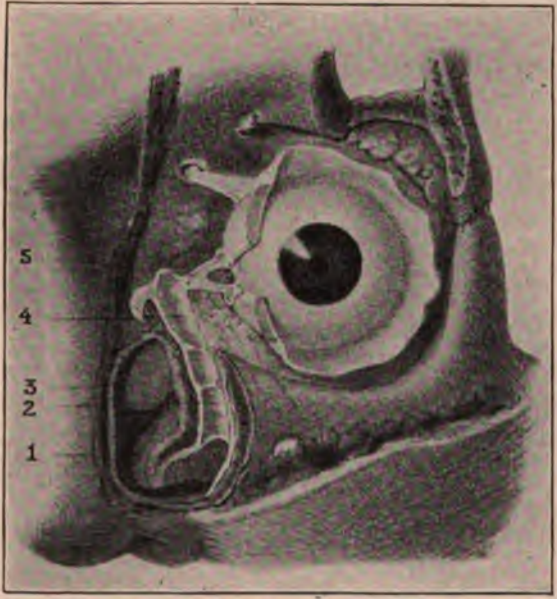


Fig. 67.—Dissection showing Nasal Duct and its Relations. 1, Inferior turbinate bone. 2, Nasal duct and valves. 3, Middle turbinate body. 4, Lacrymal sac. 5, Lacrymal canaliculi and their orifices.

G. E. de Schweinitz, in his work on the eye, 1893, says: "Diseases of the lacrymal sac are rarely primary. In nearly every case of disease of the lacrymal sac and of the lacrymo-nasal duct morbid conditions of the nasal chambers and of the naso-pharynx are present. Although it might seem natural that conjunctivitis, and especially purulent conjunctivitis, should cause lacrymal disease, this is by no means frequently the case. Conjunctivitis and blepharitis, so often accompanying diseases, follow rather than cause the lacrymal affection. Obstruction of the duct and diseases of the sac are sequels of measles, scarlet fever, and especially small-pox, because these exanthemata are accompanied by inflammation of the nasal mucous membrane."

George M. Gould says that in the vast majority of cases of related affections of the nose and eye the nose is the point of departure of the morbific process, the eye more seldom setting up disease in the nose.

Bresgen observes that the nose is infrequently invaded in conjunctivitis, while the eye is implicated in coryza.

Thomas F. Rumbold, in 1866, emphasized the importance of nasal catarrh as a cause of eye affections.

Gruhn reports thirty-eight cases of dacryocysto-blennorrhœa associated with hypertrophy of the turbinals, spurs and deflections of the nasal septum, and atrophic rhinitis and pharyngitis. He attributes the lacrymal troubles to the nasal diseases.

W. Franklin Coleman, of the Chicago Post-graduate Medical School, expressed his views in a private letter to me on February 4, 1898, to the effect that in nasal inflammation, whether independent of or accompanied by hay fever, it is common to find the ocular conjunctiva hyperæmic or inflamed. Many cases of epiphora are not due to stenosis of the lacrymal passages, but to a nasal disease. Purulent inflammation of the lacrymal sac has its origin, as a rule, in a nasal disease, and rarely in an ocular affection. The extension of rhinitis to the nasal duct is followed by stenosis, decomposition of the contents of the sac, and suppuration. Asthenopia, occasionally, is not relieved by correction of refractive or muscular errors, neurasthenia, or other constitutional faults. In these cases relief comes through attention to the etiological factors: nasal diseases. Phlyctenular conjunctivitis and keratitis, though often essentially due to malnutrition, are so frequently accompanied by rhinitis and eczema of the lower lid and face that we may assume the nasal disease to be a causative factor of the ocular. Yet, in some cases the rhinitis seems to follow the excessive lacrymation, just as the eczema of the lid and face follows the ocular disease and its attendant epiphora.

R. W. Seiss has reported several cases of closure of the nasal mouth of the lacrymo-nasal duct caused by unskillful use of the cautery. The effect on the drainage of tears is evident.

A number of illustrative cases are reported in the "American Year-book of Medicine and Surgery" for 1897. Among them is a case cited by Panas, in which there was double purulent dacryoadenitis, coincident with a severe tonsillitis and muco-purulent nasal catarrh. Ramsey, in treating of lacrymal obstructions, advocates the necessity of examining the nasal fossæ, of treating inflammatory or hypertrophic conditions found, and of investigating for a syphilitic history.

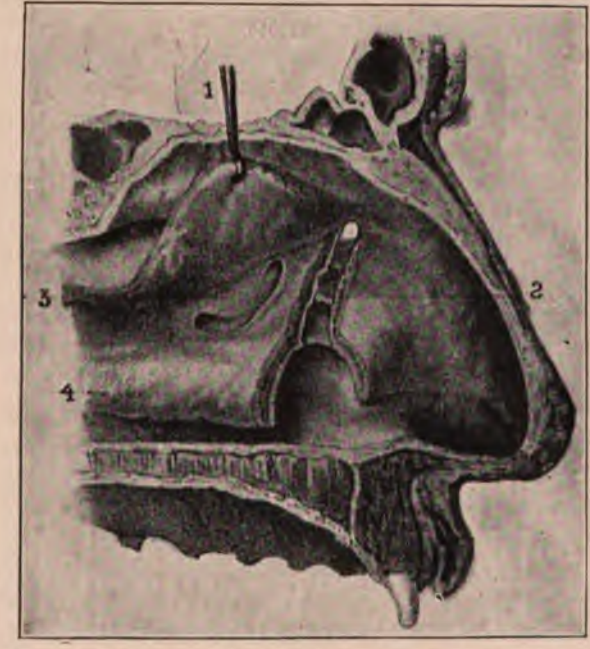


Fig. 68.—1, Middle turbinated body turned aside and held by a hook. 2, Nasal duct and valves. 3, Canal leading to the maxillary and frontal sinuses. 4, Inferior turbinated body showing location of the mouth of the nasal duct in the *cul-de-sac*.

T. K. Hamilton found eye diseases in 51 out of 106 cases of postnasal vegetations. In 6 of these there was blepharitis, in 7 follicular, in 16 granular, and in 22 catarrhal conjunctivitis.

John Dunn believes that in the vast majority of cases of children suffering from phlyctenular troubles there will be found a coincident rhinitis, and behind this unhealthy adenoid vegetations.

Samuel G. Dabney has seen obstinate cases of ciliary injection and lacrymation disappear immediately on removing a septal spur which was pressing against a turbinated body. Photophobia and asthenopia are occasionally caused by hypertrophic rhinitis. More grave diseases, such as glaucoma and organic affections of the optic nerve, have also been attributed to nasal influence.

D. B. St. John Roosa, in his book on the eye, in treating of lacrymal catarrh, says that in a large proportion of cases it is a purely catarrhal affection, produced by the same causes that bring on catarrh in other parts of the naso-pharyngeal tract, colds in the head, and catarrhal conjunctivitis.

Influenza has given rise to orbital cellulitis, and out of three such cases recently two have died of the influenza.

Nieden maintains that phlyctenular keratitis almost invariably takes its origin from a disease in the nose.

Puech observed instances of lacrymation occasioned indirectly by decayed stumps of teeth which set up chronic inflammation of the antrum of Highmore and the nasal fossa, thence extending upward into the nasal duct (Fig. 65).

Herman Knapp records an instance of lupus extending from the nasal fossa toward the lacrymal canal, followed by dacryocystitis.

Bresgen lays stress on the causal relation of nasal disease to stricture of the lacrymal canal, and insists that every lacrymating patient, even when he first visits an ophthalmic surgeon, ought immediately to be referred to a rhinologist for a scientific examination, and for eventual nasal treatment.

Fischer attributes cases of chronic conjunctivitis, trachoma, iritis, keratitis, and glaucoma to ozæna; and gonorrhœal ophthalmia has been traced to infection by way of the nose and the lacrymal canal.

Guenod states that the pneumococcus, which is a normal resident of the upper, anterior air-passages, has been found in conjunctivitis, dacryocystitis, deep ulcers of the cornea, and in panophthalmitis.

Guttman has reported a case of diphtheric conjunctivitis in which true diphtheric bacilli were found, occurring during an attack of measles, and which was complicated by corneal abscess, purulent cellulitis of the lids and cheek, and extension of the false membrane to the nose and throat. Antitoxin was injected early, but had no influence whatever in staying the progress of the disease or in averting a fatal termination. On the other hand, Coppez and Funk speak, from a large experience, in the highest terms of the efficacy of serum-therapy in the treatment of diphtheric conjunctivitis.

An appearance of excessive lacrymation may be caused by an obstruction to the passage of tears into the nose, due to ethmoid disease or pressure of a nasal polypus or other growth on the nasal duct. On account of this the tears flow over the lid and cheek (epiphora). Ethmoid disease may produce sufficient pressure to increase the distance between the eyes, causing the globes to protrude, and giving the appearance known as frog-face (Fig. 71). These variations in the anatomical relations of the bones of the orbit and the recti muscles may produce disturbances of the functions of the eye, such as strabismus and astigmatism; or overdevelopment of the sphenoid bone may produce pressure on the optic nerve and impair or destroy its functions. Thus it will be seen that a growth in the nasal fossa, exceeding the natural limit of the cavity, may be the cause of serious ocular disturbances.

Hansell referred acute, double optic atrophy in a young man to a purulent disease of the ethmoid and sphenoid cavities.

Reflexes.—In 1882, and later, Hack called attention to the probability of reflex ocular symptoms originating in pathological conditions of the nasal cavities. He also observed the causative relation of inflammatory conditions of the Schneiderian membrane to sick headache, neuralgia, cough, asthma, pain and swelling of the eyelids, and that, while the ordinary treatment for these latter affections was ineffective, they yielded to measures which restored the pituitary membrane to its normal condition.

Recently M. Georges Laurens has pointed out that more extended experience has added a large number of morbid phenomena to those that Hack regarded as taking their departure from nasal affections. Among these are epilepsy, vertigo, nightmare, sensations akin to those produced by a foreign body in the eye, heat, pricking, injection of the conjunctival blood-vessels, amblyopia, amaurosis, and photophobia.

Numerous illustrative examples could be cited in which reflex irritation of branches of the fifth nerve occasions ocular disturbances, such as conjunctival irritation and lacrymation. When these symptoms are owed to diseased conditions of the inferior turbinated body they have disappeared on cauterization of the turbinal. On the other hand, Alt reports a case of optic neuritis consequent upon cauterization of the turbinals in a syphilitic patient. "The reflex troubles of motility consist of blepharospasm, strabismus, mydriasis, and asthenopia; the trophic disturbances consist in congestion of the conjunctiva, iritis, and glaucoma, while exophthalmic goitre may, in some instances, be regarded as a condition associated with disease of the nasal mucous membrane. Contraction of the visual field has been observed by several practitioners. The affection of the eye is always, in accordance with the law of unilaterality, on the same side as the disease of the nose, though, in accordance with the law of symmetry, in some instances both eyes are affected, and in accordance with the law of intensity the eye primarily affected is always the most severely attacked." ("Year-book of Treatment," 1897.)

The nasal diseases that are the most prolific of ocular manifestations are chronic hypertrophic rhinitis, especially when there are contact, pressure, and even adhesions of the nasal septum and turbinals; acute rhinitis, inflammation of the membrane lining the sinuses connecting with the nose, ulceration of the nasal membrane, ozæna, and polypoid growths. "The reflex conditions that may be excited have reference to the sensibility of the eye, to the character of the secretions, to motility, and to trophic and vasomotor disturbances." (Laurens.)

The effects of nasal hypertrophy, pressure, irritation, and consequent ocular and other disturbances were well exhibited in a somewhat exaggerated case in the author's practice. A musician, 22 years old, presented symptoms of amblyopia and chronic non-suppurative inflammation of her middle ear, with subjective noises. The morbid manifestations were confined to her left eye and ear. The results of examination of these organs were negative, but there was an osseous adhesion between the left middle turbinated body and the septum nasi, and hypertrophy of the inferior turbinal of the same side. The patient suffered from frontal headache; and a most peculiar and interesting incident was a loss of power and uncomfortable sensations in her left arm, together with pain in her left side. The asthenic condition of her arm, combined with the impairment of vision, compelled the young lady to discontinue her piano-playing. After thorough electrocauterization of the inferior turbinal and the removal of the osseous synechia, not only did the eye and ear disturbances subside, but the neurasthenic symptoms referable to the left arm and side also vanished. Normal sight and hearing were restored, the subjective noises ceased, the headaches disappeared, and the power and natural sensibility of the arm returned.

Henry D. Noyes, in his work on the eye, relates the case of a medical friend who suffered from asthenopia, headaches due to excessive strain of accommodation, heat at the vertex of the head, insomnia, facial neuralgia following use of the eyes, and intense photophobia—a case of refractive and muscular and general nerve-exhaustion. There were extreme palpebral congestion and a tendency to lacrymation on exposure to light and attempting eye-work. The nasal passages were found to be narrow, with a slight protuberance of the septum from undue thickening, decided congestion, and tenderness on being touched. Anæsthesia by cocaine afforded relief in some measure to the eye-symptoms. Examination of the eye, after the fitting of glasses failed to afford relief, showed that there was much spasm of the extrinsic and ciliary muscles. Sprays, the ingredients of which were not mentioned, afforded relief. The patient was an asthmatic. After removal of the thickened portion of the septum with a saw, marked improvement took place, and within four months the patient laid aside his glasses and was restored to a condition of comfort.

Galezowski has seen persistent lacrymation caused by slowly growing exostoses of the nasal cavities.

S. S. Bishop, of Pennsylvania, observes that discomfort of the eyes and lids and vasomotor disturbances are sometimes the reflex effects of diseases of the nasal mucous membrane. He lays especial stress on spurs of the septum nasi and hypertrophy of the turbinate bodies as causes of these troubles.

Cheatham is authority for three cases of asthenopia accompanied by other ocular symptoms. In each instance the ciliary weakness was found to be dependent upon local nasal trouble, such as catarrh, polypi, obstructions from deflected nasal septum, or engorged tissue. Ocular relief and strength immediately followed upon a cure of the nasal abnormality.

Many sufferers from hay fever are attacked with itching of the lids, lacrymation, injection of the conjunctival vessels, and photophobia during the season of suffering. The first attacks of this disease are likely to be announced by the appearance of itching and suffusion of the eyes.

Diseases of the eye are sometimes responsible for pathological states of the nose. Of 315 cases of functional nervous affections examined by Miles with reference to eye-strain, 107 presented nasal symptoms, such as frequent sneezing, epistaxis, and annoying sensations referable to the nasal fossæ. Nearly all of these cases had errors of refraction. After relieving the ocular irritation by correcting the ametropia with proper lenses the nasal symptoms diminished or disappeared. This was particularly true of those cases characterized by asthenopia and headache. Ocular disturbances that cause a profuse flow of tears give rise to nasal hydrorrhœa and chronic rhinitis.

Treatment.—When ocular disturbances are suspected of being caused or perpetuated by diseases of the nasal cavities,—for example venous stasis, stenosis, or reflex irritation,—we may often be able to demonstrate the correctness of our conclusions by the application of suprarenal extract or cocaine to the diseased area. If it relieve the ocular symptoms, the line of successful treatment is indicated; but one had best bear in mind the case recorded by Marckwort, in which glaucoma followed a prolonged application of cocaine in the nose. Moreover, the author has met with cases in which the secondary effect of cocaine on the nasal mucous membrane was that of paresis of the blood-vessels, engorgement and complete nasal stenosis, with intensified symptoms of hay fever.

When obstruction to the free drainage of the tears through the nasal duct into the nose depends upon a disease of the nasal fossa, the latter must receive prompt treatment, as laid down in the foregoing chapters. In all such cases the nasal cavities should be thoroughly examined without delay, and in many the nasal treatment alone will suffice to establish a normal condition. But the disease may have progressed so far as to call for treatment addressed to the lacrymal drainage-canal itself. Stenosis, fibroid adhesions, etc., may have produced permanent changes in the nasal duct or the lacrymal sac that will require special attention from the ophthalmic surgeon. However, tentative treatment should be instituted first, and it may succeed in obviating the necessity for surgical interference.

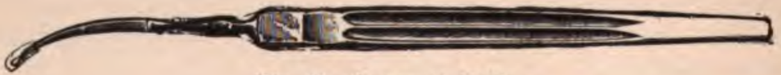


Fig. 69.—Lacrymal Knife.

The lacrymal sac can be emptied of pent-up secretions by gentle pressure, and the eye should be washed clear of them by a 2-per-cent. solution of boric acid in distilled water. If an astringent lotion is desired, sulphate of zinc can be added in the proportion of 2 grains to the ounce of the solution. The manipulation and medication are effected in the following manner: The surgeon's finger is made to exert pressure on the sac from below and toward the eye, while the patient's head is tilted backward and toward the opposite side. After the sac is emptied of secretions the boric solution is made to rest in a little pool over the canaliculi while the sac is emptied as before, with the result that the solution enters the evacuated sac and medicates the nasal duct. This simple treatment, combined with proper measures addressed to the nasal disease, will cure a large proportion of these cases.

When this method proves ineffectual, the orifice of the canaliculus (Fig. 67) must be enlarged. This can be done with the iris-scissors or the lacrymal knife (Fig. 69), which is introduced with the sharp edge directed toward the eye, cutting the punctum open perpendicularly toward the palpebral fold for a distance of about one-sixteenth of an inch (two millimetres) or more. The lower canaliculus is the one that is generally opened. Then the solutions just mentioned, or silver nitrate, 2 to 5 grains to the ounce of water, should be used until either a cure is effected or it is demonstrated that there is a stricture of the duct. In the latter case the smaller probes of Bowman may be gently employed to dilate the stricture. For further surgical treatment the reader is referred to works on the eye.

CHAPTER X.

DISEASES OF THE NASO-PHARYNX.

NASO-PHARYNGEAL CATARRH.

Synonyms. — Post-nasal catarrh; rhino-pharyngitis; retronasal catarrh; follicular naso-pharyngeal catarrh.

Pathology. — Naso-pharyngeal inflammation may be acute or chronic, but the acute stage merges in the chronic form, leaving a thickening of the mucous membrane,—a proliferation of tissue that gives rise to a roughened and granular appearance of the membrane and increased secretion from the mucous glands. This is the condition most often encountered, but the dry form is not uncommon.

Etiology.—Sudden and extreme changes in meteorological conditions, especially in a low, damp climate, are undoubtedly the chief exciting causes of this disease. Inhaled dust is another important etiological factor; but climatic conditions are of prime importance; otherwise, those who live in a dusty atmosphere, but in a warm, high, dry, equable climate, would suffer equally with those under the reverse conditions.

This disease is most common in the region of the Great Lakes and, indeed, in many other parts of America. Even in Colorado, the Mecca of consumptives, this disease prevails. But the soil favors this, for it is so light and sandy that the rains percolate through into the subsoil in a few hours, leaving on the surface a fine coat of dry dust, the toy of the winds and the torment of catarrh. In the Mississippi Valley and the Great Lakes Region the barometrical and thermometrical changes are rapid and excessive. The thermometer often falls thirty degrees or more in a few hours, and half that much in as many minutes. In hot summer-days, with southerly winds, cold waves sweep down from the northwest, catching the people in thin clothing, chilling the skin, and causing internal congestions that naturally attack the respiratory passages. The dampness of the atmosphere and the prevalence of dust aid in locating the seat of irritation in the most exposed air-cavities. After these sudden attacks of cold waves an influx of patients usually attests the cold-giving nature of the changes.

I have found San Francisco no better than Chicago in climatic conditions. The fogs of the early morning and the cold, penetrating winds of the afternoon, with only a few hours of congenial warmth to lure one to don warm-weather attire, present the conditions favorable to the production of naso-pharyngeal catarrh. But the reverse of this picture is to be found by a twenty-minute ride across the bay to Oakland. There one may doff his overcoat and bask in the balmy sunshine of summer, while his neighbors a few miles distant shiver in the ocean-winds. But even here we cannot escape the irritating dust that plays hide-and-seek with the cilia of the nose. For catarrhal patients the climate of Los Angeles or San Diego is preferable to that of San Francisco; but even in these delightful gardens of America there is no escape from dust.

The part played by this irritant in the causation of post-nasal catarrh is easily understood when we consider the conformation, position, and lining of the naso-pharyngeal cavity. Its shape is such as to receive and change the course of the current of air as it strikes the vault and posterior wall of the pharynx, and all the dust-laden air inhaled through the nose must come in contact with this part. The foreign particles not removed by previously impinging on the nasal cilia or membrane find lodgment here, and, if sufficient moisture has not been absorbed by contact with the nasal chambers proper, the secretions of the pharyngeal membrane are taxed to perform this function. The resulting storage of dust and the drying of the membrane, which is devoid of the acute sensibility characteristic of the nose and larynx, and therefore lacks prompt reflex efforts at dislodgment, tend to excite irritation and consequent inflammation. Other predisposing causes of naso-pharyngeal catarrh are discussed in the chapter on "General Consideration of Ear, Nose, and Throat Diseases."

This disease, like hay fever, is undoubtedly more prevalent in America than in European countries. The reasons assigned for its prevalence in various parts of this country are sufficient to account for this difference. It is not a contagious affection, like epidemic influenza, neither can it be termed hereditary, but its universal presence is certainly suggestive of a predisposing hereditary influence. It is not limited to the frail, but is just as likely to be encountered in the robust, and especially in the uric-acid diathesis.

Symptomatology.—In the early history of naso-pharyngeal catarrh the patient notices a sense of irritation in the upper and back part of the throat. This provokes attempts at clearing the throat or hawking which is irksome to the patient and disagreeable to his companions. A sense of constriction and a tired or aching feeling is often present, especially while speaking in public. The vocal organs weary easily, and the necessary efforts to clear the throat during a lecture or sermon are wearisome to both speaker and audience. Clergymen are frequent subjects of this complaint. There is almost a universal habit among them of efforts to relieve this irritable condition of the throat.

Posterior rhinoscopy often discloses a thick, tenacious, light-yellow secretion sticking to the posterior wall of the pharynx. On removing this discharge the membrane appears very red and roughened by the formation of granulations. These are round and punctated or irregular and flat, with broad bases suggestive of particles of a filled sponge. Frequently they coalesce, especially at the sides of the throat just behind and below the posterior faucial pillars, and form a welt extending upward and outward in the direction of the Eustachian orifices. These point to the "throat deafness" so often met with in catarrhal climates. The blood-vessels are often engorged and tortuous and stand out prominently above the surface of the surrounding tissues. The Eustachian prominences are swelled and reddened and the orifices constricted or closed. Extension of the inflammation a little farther through the Eustachian openings results in tubal catarrh, or salpingitis, and impaired hearing, as already described in the ear division. The pharyngeal, or Luschka's, tonsil is sometimes hypertrophied, and in children adenoid vegetations may so occlude the vault of the pharynx as to preclude nasal respiration (Plate I). Mouth-breathing and its train of evil consequences result. The faucial pillars are more or less involved, presenting a swelled, infiltrated condition.

Diagnosis.—There is little likelihood of confounding this affection with any other. Adenoid vegetations are confined to the young and are easily seen with the rhinoscopic mirror or felt by the finger. The same may be said concerning polypi. Syphilis causes sore throat, but the characteristic erosions and the history, added to the testimony of antisyphilitic remedies, serve to dispel any doubt.

Prognosis.—Although it is the practice of charlatans to represent this disease as being dangerous to life and leading to pulmonary consumption, its early history does not confirm such statements. In its early stage it yields readily to proper treatment, but after it has existed for a number of years it becomes persistently chronic and yields only to the most thorough methods of treatment. However, much relief can be afforded by hygienic measures, combined with proper cleansing and stimulating topical applications and surgical treatment.

Treatment.—The first object of treatment is perfect cleanliness; detergents—such as Dobell's and Seiler's solutions—should be used in the form of sprays, both through the anterior nares and throat, to dislodge all secretions and crusts that adhere to the naso-pharyngeal walls. If these alkaline, antiseptic sprays, that dissolve the tenacious secretions and dislodge them in ordinary cases, are not sufficient to remove them in this form of catarrh, cotton, twisted upon a curved post-nasal cotton-carrier should be used to wipe out all the discharges. Then stimulating and tonic sprays should be applied with the Davidson or De Vilbiss atomizers. Camphor-menthol in benzoinol, 5-per-cent. coarse spray, or a 10-per-cent. solution in the form of a nebula, in the hand-vaporizer (Fig. 125) will afford decided relief. A tonic, antiseptic spray is had in eucalyptus in lavolin, 4 per cent.; or, as a tonic nebula to be used in the hand-vaporizer, an excellent preparation consists of oil of cubebs, 50 parts; pure camphor-menthol, 10 parts; and lavolin, 40 parts. However, the latter solution must not be used in the form of a coarse spray. This and a 10-per-cent. solution of camphor-menthol inhaled through the throat and exhaled through the nose act as decided stimulants and tonics. It is my practice to prescribe for home treatment a 3-per-cent. solution of camphor-menthol in lavolin, to be used every morning and night. The patient is instructed to throw a sufficient spray of this preparation into both nostrils and throat to satisfy him that the parts are entirely covered with the medicine. The application of this remedy proves very grateful and refreshing, especially to public speakers. Upon being used at bedtime it remains in contact with the mucous membrane during the hours of repose, when no efforts are made to clear the nose; so that its action is continuous over a number of consecutive hours. All hypertrophied tissues should be destroyed with the electrocautery.

Excessive tobacco-smoking must be interdicted, and those who continue to smoke must be instructed that the habit of forcing smoke outward through the nose acts as an irritant and aggravates the existing condition. The inhalation of dust; irritating gases, like those from matches, etc.; exposure to cold and damp and draughts of cold air, especially upon the back of the neck and back of the arms; and exposure of the feet to cold and wet must be avoided. Animal fibre must always be worn next to the skin. Wool is preferable to silk. Cotton and linen must not be used for underclothing. Consisting, as they do, of vegetable fibre, they favor rapid evaporation of the perspiration, causing chilling of the skin and contraction of the capillary vessels and resulting internal congestion. The diet must be plain and nutritious, avoiding an excessive use of meats, sweets, wines, and beer.

ATROPHIC CATARRH OF THE NASO-PHARYNX.

This disease usually accompanies the same condition of the nose which has already been described, but it may exist independently of atrophic nasal catarrh. In the early stage of this affection the mucous membrane of the naso-pharyngeal space usually appears dry and shining. Later, crusts are formed similar to those described in ozæna. Sometimes quite large patches of these crusts, which adhere closely to the membrane and are removed with difficulty, are expelled. They are generally of a dirty-white or greenish color and sometimes brown or even black. The latter color is usually found where patients are exposed to the inhalation of a smoky atmosphere, in the neighborhood of factories, hotels, and buildings in which soft coal is largely in use. These crusts sometimes are removed with so great difficulty that the patient frequently is under the necessity of inserting his finger into the vault of the pharynx and detaching them with his finger-nail.

The pathology and etiology of this disease are the same as for nasal ozæna, to which the reader is referred.

The symptoms consist of a sensation of dryness in the throat, which is much more disagreeable than the presence of an hypersecretion. When crusts form, decomposition takes place, imparting a foul odor to the breath. The efforts of the patient at dislodgment of these secretions cause gagging and sometimes vomiting, and for this reason they produce gastric disturbances.

The points of diagnosis are identical with those given for ozæna under the heading of "Atrophic Nasal Catarrh."

The prognosis is unfavorable. This is a persistent, chronic disease which is not easily amenable to treatment. However, much relief may be afforded until such time as the processes of nutrition can be so improved as to give permanent relief.

Treatment.—Hydrozone and antiseptic detergent solutions—such as Dobell's and Seiler's—must be used abundantly to dissolve and dislodge the crusts. When no crusts are present, but there is merely a pale, dry, shining, mucous membrane, remedies that stimulate the muciparous follicles to secretion must be used. These consist of the eucalyptol, iodine, and cubeb sprays already mentioned. Further treatment for this affection is the same as that laid down for nasal ozæna.

FIBROUS TUMORS OF THE NASO-PHARYNX.

Fibrous tumors in this locality are of infrequent occurrence (Plates II and IV). They are rarely found above the twenty-fifth year and occur more frequently in males than in females. They cause obstruction to nasal respiration, dyspnœa, epistaxis, and facial disfigurement.

Pathology.—These tumors occur singly and are attached by a broad pedicle to the roof of the pharynx. They are dense, smooth, and of a dark-red color. The blood-vessels of the interior are smaller than those of the mucous membrane covering them. Bleeding takes place easily; so that palpation with the probe causes a sanious discharge. These growths may develop to such an extent as to invade the throat even to a level with the epiglottis.

A fibroma is a representative tumor of the mesoblastic type. Like the submucous tissue from which it takes its origin, it is a connective-tissue growth, and is the offspring of a highly vascular area. It is made up of mature fibrous tissue from a matrix of fibroblasts. The growth of this neoplasm is always slow, and there is sometimes a tendency toward a myxomatous degeneration, or it may undergo a transition into a sarcoma.

Etiology.—Their cause remains in obscurity.

Symptomatology.—The most prominent symptoms are difficult breathing in consequence of the nasal obstruction, nose-bleeding, stupidity, a nasal intonation of the voice, and difficulty in articulation of speech. Pressure upon the orifices of the Eustachian tubes may cause obstruction to the ventilation of the middle ears, Eustachian salpingitis, and consequent deafness. When these growths assume large proportions they make sufficient pressure upon the surrounding structures to broaden the base of the nose and increase the width between the eyes, giving the appearance suggestive of the "frog-face" (Fig. 71). Pressure may be sufficient to cause separation of the nasal bones and absorption of the facial and cranial bones, producing intracranial complications. There is generally a copious muco-purulent discharge and difficult deglutition.

Diagnosis.—These tumors are differentiated from mucous polypi by their hardness, frequent bleeding, and their occurrence only under the twenty-fifth year. They are distinguished from adenoid vegetations in the vault of the pharynx by the soft, spongy, lobulated appearance of the latter and their occurrence only in the very young. The appearance of the two in the rhinoscopic mirror and the sensations imparted to the finger introduced into the naso-pharyngeal space render a differential diagnosis not difficult.

Prognosis. — Fibrous polypi pursue a steady growth until, in from three to five years, they prove fatal. If their development can be repressed by local treatment until the patient arrives at the age of twenty-five years, the prospects of recovery are improved. But one should bear in mind Virchow's saying that "a fibroma only needs an increase in the size of its cells and a diminution of the cement-substance to change it into a sarcoma." Such a growth located in the pharynx is subjected to a large amount of irritation, which favors a degenerative transition into a sarcoma.

Treatment.—These growths should be removed with the galvano-cautery snare, electrolysis, écraseur, powerful cutting forceps, or a curette. Before the operation for removal is commenced the body of the growth should be secured by a strong thread so as to prevent its dropping into the throat and producing suffocation. Curative results have been claimed by several writers from injections of alcohol, caustic potash, chloride of zinc, dilute acetic acid, or hydrochloric acid, etc., into new growths. For a further consideration of this subject see "Treatment" of "Cancer of the Pharynx."

Electrolysis is especially indicated for growths having a sessile formation, which precludes the use of torsion or the snare. For this purpose a strong current is employed under general anæsthesia. Much has been claimed for the method of introducing medicaments with the electric current, or cataphoresis, but, whenever it is practicable to remove the tumor in its entirety, it should be done.

Operations of several kinds are practicable according to the size and the situation of any given growth. The old method of removal by the cold-wire snare is in quite general use, but on account of the great vascularity of these tumors and the consequent operative hæmorrhage, the electric snare recommends itself, since it sears over the tissues and closes the mouths of the blood-vessels with coagula as the tissues are being severed. For the same reason, in those cases in which the form and position of the attachments of these neoplasms lend themselves to such a procedure, the use of the electric knife at a white heat is advantageous. Torsion can be practiced when the tumor is distinctly pedunculated.

Certain cases of fibromata can be operated on through the natural oral or nasal channels. Others, either on account of peculiarities of attachment or excessive or irregular development, must be removed through the soft or hard palate, or by means of resecting the nasal bones or the superior maxilla. Sufficient room for operating may be obtained by dividing the nose along the side of the septum, beginning at the nasal process and cutting from within outward. If more room is required, the nasal process is resected, and still better access is afforded by incising the upper lip in the middle line and separating its attachments liberally. The tumor is then detached by one of the methods already mentioned, or by the periosteal elevator, or by blunt-pointed scissors, when it is drawn out with strong forceps. These are very bloody and dangerous operations and may require a preliminary tracheotomy and ligation of the common carotid artery. Special operations have been devised by König, Dieffenbach, Langenbeck, Rouge, Ollier, Kocher, and others. After removal, the attachment of the pedicle should be thoroughly cauterized.

Fibromucous Polypi of the Naso-pharynx.

These tumors are of somewhat rare occurrence. They vary in size from one to three inches (two to eight centimetres). They are smooth, oval, and of a dusky-red color and occasion nasal obstruction and deafness, but no hæmorrhage. One serious inconvenience occasioned by them is the inability to blow the nose.

Pathology. — Unlike the fibrous growth, which occurs on the under surface of the basilar process, the fibromucous polypi, springing from the connective-tissue fibres and mucous elements, naturally partake of their character. They are dissimilar to the fibrous polypi; are adenoid in appearance, texture, and history; and they do not tend to recur after extirpation.

Treatment. — Evulsion should be made with strong forceps through the mouth, or the cold-wire or galvanocautery snare can be used through the nose. After their removal the site of attachment should be cauterized.

MALIGNANT TUMORS OF THE NASO-PHARYNX.

These tumors are of very rare occurrence. They are attended with pain in the throat and back part of the nose, extending to the ear; catarrhal symptoms, with increased discharges from the nose and throat; difficulty in swallowing; and, as they progress, general impaired nutrition. They are likely to be of the sarcomatous type, either pear-shaped or lobulated (see "Sarcoma" of the pharynx, page 239). Their growth is rapid, and there is a strong tendency to recurrence after their removal. Only a microscopical examination will reveal their true nature. They are likely to be mistaken for fibrous polypi, but are less dense, softer to the touch, and present quite a different history.

The prognosis is hopeless.

Treatment consists in their removal, if possible, with the means already detailed for operations upon fibrous tumors. Supportive and tonic remedies should constitute a part of the treatment. (See "Carcinoma of the Pharynx," page 232.)

ADENOID VEGETATIONS IN THE VAULT OF THE PHARYNX.

Synonyms.—Hypertrophy of the pharyngeal, or Luschka's, tonsil.

Pathology.—These growths occur in two varieties. The first consists of spongy, stalactite projections from the vault of the pharynx; the second of smooth, fibrous tumors of irregular shape. They are very vascular and contain lymph-cells and a follicular structure resembling that of the oral tonsils.

The relation of adenoid growths to deaf-mutism has been made the subject of investigation by Frankenberg (*American Medico-Surgical Bulletin*, December 10, 1897). He examined 158 inmates of the deaf-mute institute in Prague. Including adenoids only that were large enough to fill the naso-pharyngeal cavity, there were 59 per cent. with these growths. Out of the 94 cases, there were 56 boys and 38 girls. The particular pathological conditions of the ears in these subjects can be found under the heading "Deaf-mutism," page 526. Among 426 cases of adenoids Arslan found 6 deaf-mutes. He cured one and relieved another of these, both as to speech and hearing, by removing the adenoid growths (Plate I).

The superior maxillary bone often presents a contracted appearance; the roof of the mouth is narrow and is highly arched, conveying the impression that the conformation of the roof of the mouth has resulted from the necessities of constant mouth-breathing, enlarging the cavity of the mouth at the expense of the nasal fossæ (Fig. 70).

Etiology.—This is usually a disease of childhood and is oftenest seen under the tenth year. Heredity is an important factor. Ofttimes several children in the same family are subject to these growths. They are always to be looked for in children with hypertrophic rhinitis, enlarged faucial tonsils, and high-arched or cleft palates.

Symptomatology.—The most striking features in a pronounced type of this affection are the parted lips, prominent eyeballs, obliteration of the normal lines of expression of the face, and a consequent appearance of listlessness and inferiority (Fig. 71). Mouth-breathing, a noisy respiration, snoring, and a lack of resonance of the voice are the typical symptoms. There is a characteristic thickness of speech, and nasal intonation. As Chaucer said, "He intones in his nose." Such children are absent-minded and have the appearance of being inattentive, which may be due to mental dullness or impaired hearing, or both. There are inability to fix the attention, or aprosexia (Rumbold), and defective memory. There is a plentiful, tenacious discharge of a grayish or bloody color. Examination with the finger causes bleeding. The history is one of recurring colds in the head,

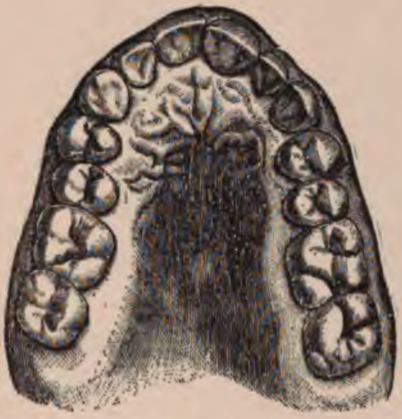


Fig. 70.—Contracted Upper Jaw; Narrow Roof of Mouth with very High Arch, Encroaching upon the Nasal Fossæ; Found in Habitual Mouth-breathers who have Adenoid Vegetations in the Vault of the Pharynx. Hypertrophied turbinals and oral tonsils are often associated with these conditions.

earache, diminished hearing, noises in the ears, or otorrhœa. There may be pressure on the Eustachian tube or an extension of the adenoid inflammation through the Eustachian tube to the ear. The growths are light pink, turning to red on being irritated. They obstruct posterior rhinoscopy, and are often unequally developed on the two sides. The symptoms given are of typical cases; in many they are not so well defined.

We have sometimes been able, by anterior rhinoscopy, to observe the growths through the nose, when the passageway was unobstructed. While writing this, such a case is under observation preparatory to an operation. Although there is great hypertrophy of the left inferior turbinal, producing stenosis, the right fossa is so capacious as to admit of an excellent view of enormous adenoid growths. While the patient counts aloud to 30 or 40, the growths can be seen moving freely with the enunciation of the various numbers. In this case, a boy of 15 years, examination with the throat-mirror is not difficult.

Diagnosis.—The symptoms described render this a simple matter. The rhinoscope is not easily used in children, and we rely principally upon the digital examination, with the finger well protected.

Prognosis.—The tendency is to absorption during early adolescence and to disappearance when adult age is reached.

Treatment.—Notwithstanding the fact that, with the advent of adult life, adenoid growths in the vault of the pharynx tend to absorption, there are most excellent reasons why it is for the patient's interest to be rid of them. Semon has formulated these reasons as follow: (1) the ever-threatening danger of ear complications; (2) the greater liability to, and seriousness of, infectious diseases, especially scarlet fever and diphtheria; (3) the influence of the obstruction on the general health, mental development, and the formation of the face, results which may remain even if the glands themselves undergo atrophy.

While it is the practice of some rhinologists to treat adenoids with washes, sprays, caustics, the galvanocautery, etc., for periods varying from four to fourteen months, I much prefer the one painless operation, lasting but five minutes and insuring a radical cure.

The instruments are sterilized by boiling for five minutes in a 1-per-cent. solution of bicarbonate of sodium, and placed within easy reach. The mouth-gag (Fig. 72) is inserted between the molar teeth before the anæsthetic is administered, and is held carefully in place by an assistant until the operation is completed; otherwise it slips out of place and allows the jaws to close, after which they are separated with much difficulty. Sections of soft-rubber tubing should be slipped over the dental extremities of the gag to protect the teeth and prevent slipping.

The preferable anæsthetic for this operation is ethyl-bromide (hydrobromic ether; monobromethane). It is dispensed in 1 (fluid) ounce tubes. Before administering it the patient should be calmed into a tranquil state of mind, for if there is great excitement the drug is not so efficacious. The patient is held in a sitting posture on an assistant's lap (Fig. 73), with his feet and arms gently, but firmly, pinioned. An ounce of the bromide of ethyl is poured into the inhal-

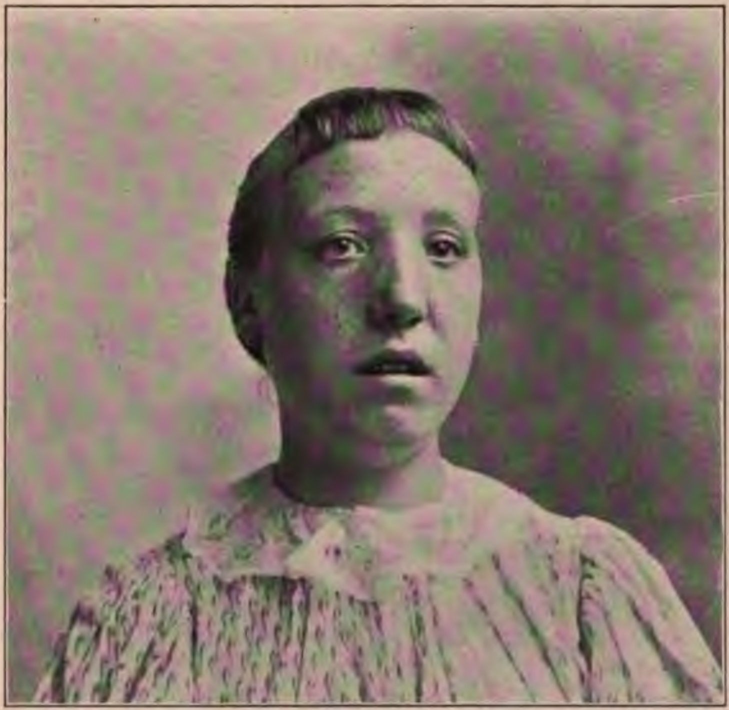


Fig. 71.—A Mouth-breather (17 years old). (Author's Case.) Adenoid vegetations in the vault of the pharynx; hypertrophied oral tonsils; bilateral nasal polypi; spreading of nasal bones, producing great breadth of nasal arch; protrusion and wide separation of eyeballs (frog-face); suppurative ethmoiditis requiring curettement; and chronic suppuration of both middle ears.

ing-cone or mask and given in the same manner as in etherization, allowing a minimum of air to enter. Anæsthesia is induced in about one minute and lasts about five minutes. Probably not more than half an ounce of the anæsthetic is taken, but the remainder will not keep for subsequent use on another day and must be thrown away.

Fessler gives excellent, practical suggestions regarding the use of ethyl-bromide: The preparation must be pure and fresh. The contents of a bottle must be used up the same day that the bottle is opened or else thrown away. Preparations that have been exposed to bright light or to air should not be used. For this reason, also, the cloths or flannel masks which have once been employed in producing the narcosis should not be used again before having been thoroughly cleansed and aired.

A good device for administering the anæsthetic can be improvised by wrapping a thick towel into the form of a cone and tying a strong cord about its apex to render it the more air-tight, or it can be folded into a box shape and pinned with safety pins. Into this inhaler should be placed sufficient clean cotton to absorb the fluid. When an Esmarch mask is used for narcosis with bromide of ethyl the flannel should be double the usual thickness, and folded in two layers.

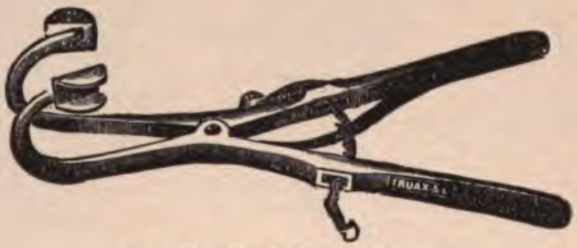


Fig. 72.—Denhart's Mouth-gag.

As soon as the patient is quieted by the means usually employed by anæsthetizers and hypnotizers he is directed to draw a long, deep breath, to breathe quietly; then the inhaler, into which the anæsthetic has just been poured, is held closely over his nose and mouth. A slight extension of the extremities will be noticed to follow after a few inspirations, and the breathing usually continues deep and quiet. Complete anæsthesia is attained as soon as this extension begins to disappear, and at this instant is the time to operate rapidly, for sensibility returns again in a few minutes. We may prolong the narcosis for a few minutes, only, by adding another ounce (30 grammes) of the bromide of ethyl to the inhaler. The patient quickly recovers consciousness, and after lying down for half an hour or more he is ready to be taken home.

The instant anæsthesia is complete Gottstein's large or small ring-curette (Fig. 74) is inserted behind the velum palati and upward near the vomer to engage the central, highest mass first. Then the cutting-surface is passed backward and downward in contact with the posterior pharyngeal wall as far as the growths extend. The same movement is executed on either side wherever there are growths, sweeping them all out by three or four passes of the curette. Finally the finger is inserted to discover if any remain. If so, they may be detached with the finger-nail or the curette. J. E. Schadle operates by means of the finger-nail trimmed to a point and hardened by immersion for a few minutes in alcohol. (*The Laryngoscope*, July, 1896.)

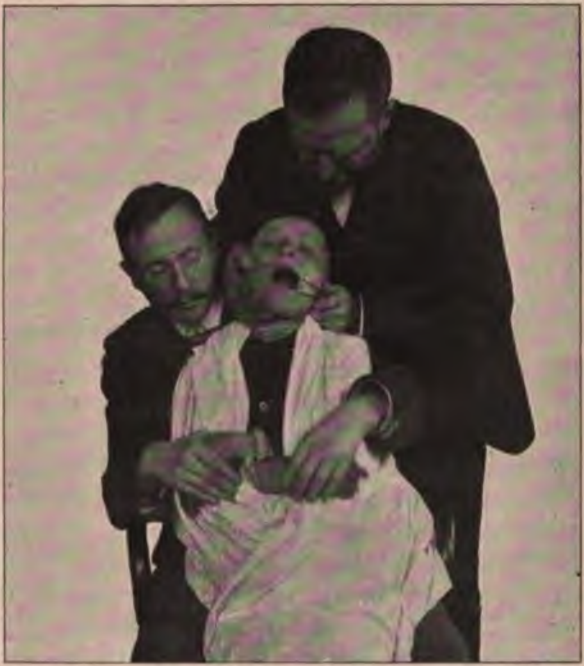


Fig. 73.—Position of Child for Adenoid Operation or Intubation; Mouth-gag Introduced.

As soon as all the adenoid tissue is extirpated, the gag is removed and the patient's body is inclined quickly forward, with the face downward. The surgeon loudly commands the patient to "spit it out!" Hence the blood escapes through the nose and mouth and the patient at once begins efforts at expulsion, and the blood is thereby prevented from entering the larynx or the stomach.

If the faucial tonsils are hypertrophied, they are removed before the adenoids. This order of operating presents two advantages: the space through which we operate is amplified and there is no bleeding from above to obscure the tonsillotomy. The operator must waste no time, but, if he act promptly and rapidly, there is sufficient time for all this procedure under the anæsthesia.

Hæmorrhage lasts but a few minutes and generally ceases by the time full consciousness is restored. This method deprives the operation of the horrors experienced by children whose adenoids are extirpated without anæsthesia; and neither children, nor parents who are excluded from the room until the bleeding ceases, retain any revolting memories of the affair or their doctor. Many cases receive no after-treatment; but it is better to give a spray of camphor-menthol and benzoinol—3 per cent.—with an atomizer (Fig. 11) for home use four times a day for a week or more.

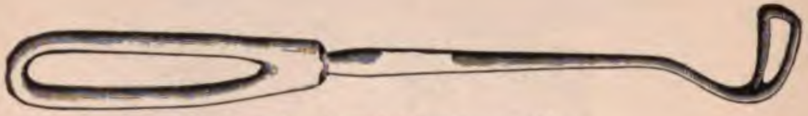


Fig. 74.—Gottstein's Ring-curette.

While instances of severe hæmorrhage from this operation are reported, I have never witnessed any. C. H. Knight reported a case of death from hæmorrhage following an operation for adenoids in a boy 4 years old. Death occurred two days after the operation. (*The Laryngoscope*, April, 1898.)

James E. Newcomb had three cases of hæmorrhage. One was a woman about 18 years old. Another was a girl of 13 years whose adenoids were removed under cocaine anæsthesia. Bleeding occurred forty-eight hours after the operation. In the third case, which was a fatal one, the patient was a boy of 4 years. Four hours after the operation hæmorrhage set in, and terminated fatally on the morning following the operation. The two other cases recovered. On looking up the subject 16 cases of hæmorrhage were found following adenoidectomy, with 2 deaths.

Hooper reported a case of death following a digital examination.

Among 11 cases of these hæmorrhages 4 occurred in patients under 10 years of age, 5 were between 10 and 20 years of age, and 1 was 28 years old. Chloroform was used in 3 cases, and cocaine in the same number. Various instruments, as well as the finger-nails, were employed. Generally the hæmorrhage takes place immediately after operating, but it has occurred as late as 24 and 48 hours afterward.

Delavan has reported a fatal case in a child of 4 years, and 3 other cases whose ages are not given. In Delavan's case there was a bleeding diathesis.

Newcomb mentions "a case of a boy 2 1/2 years old who had adenoids removed with the finger and forceps, under ether. Hæmorrhage occurred 8 hours afterward, and death in 24 hours."

Van der Poel reports 2 cases of profuse bleeding in his practice. The first, a girl of 8 years, was a case of hæmophilia. She had suffered one year before from an alarming hæmorrhage following the extraction of a tooth. The second was a boy of 14 years who was operated on without anæsthesia, and who had a mitral regurgitant murmur resulting from rheumatic endocarditis. Both cases recovered. In case of serious hæmorrhage the vault of the pharynx should be thoroughly packed with cotton wet with a saturated solution of suprarenal extract, in the manner detailed in the section on epistaxis.

In my experience with the operation none but satisfactory results have obtained. One needs to take care not to wound the orifices of the Eustachian tubes or to drag a mass of the adenoid tissue down into the throat and leave it hanging there by the pharyngeal membrane intact. We have observed this condition after what must have been a hasty and incomplete operation. The finger should not be inserted into the pharyngeal vault while the curette is in action; but one should not fail to examine immediately after curetting to ascertain if the adventitious tissue has been completely removed. We have never observed any bad effects from ethyl-bromide. It is as safe as ether and far preferable for such short operations.

The operation is not formidable if skillfully performed. It should be a thorough curettement, and the cavity is not difficult of access, providing that the mouth is kept properly gagged. In a large number of operations by my assistants and myself with bromide-of-ethyl anæsthesia no accident or hæmorrhage of importance has occurred.

Referring to the operation under this anæsthetic, T. Melville Hardie says:—

"The advantages of the drug are:—

"1. The laryngeal reflex very probably persists, and any blood or tissue entering the larynx is promptly expelled.

"2. The sitting posture of the patient, possible in the exhibition of this anæsthetic, is the most convenient one for operating upon tonsils and adenoid growths, and makes easy the passage of blood from the nose and mouth; little of it is, as a rule, swallowed.

"3. Nausea and vomiting are rare, and the patient generally experiences but little discomfort after the operation.

"The disadvantages of the anæsthetic are:—

"1. It is not perfectly safe, four or five deaths having been reported.

"2. The time of anæsthesia is not always long enough to permit of thorough operation. In my experience this is not usual, but it cannot, on the other hand, be called very infrequent.

"3. The anæsthetic is not always well taken."

Witzel, who reports 465 anæsthesias, and who believes it to be the least dangerous anæsthetic, tabulates the following unpleasant effects occurring in 28 cases:—

"*(a)* Great excitation in 9 cases, in 4 with much sweating.

"*(b)* Cyanosis in 2 students somewhat the worse for liquor.

"*(c)* Asphyxia, but rarely with his method: first a few drops, then the whole quantity of the anæsthetic.

"*(d)* Malaise, lassitude, vomiting.

"*(e)* Urination in 3 cases.

"*(f)* Great sexual excitement.

"*(g)* In 2 cases he could not produce anæsthesia with 1 and 2 ounces."

CONCLUSIONS.

1. Adenoid vegetations should be removed under general anæsthesia in the great majority of young children.

2. The cold-wire snare and cocaine anæsthesia are satisfactory in older children and in adults, but cocaine should not be used in young children.

3. Nitrous-oxide anæsthesia is frequently of too brief duration for the proper performance of this operation.

4. Ethyl-bromide, apart from the question of its safeness, which is still undecided, is a desirable anæsthetic in many cases.

5. Ethyl-bromide is not well taken, as a rule, by very nervous or frightened children.

6. Ether should be substituted for bromide of ethyl when the operation is likely to be a lengthy one.

7. The Gottstein curette is, all things considered, the most satisfactory single instrument, and particularly in bromide-of-ethyl operations.

Accidents Attending Adenoid Operations.

"C. R. Holmes and H. S. Garlick contribute personal experiences in breaking Gottstein curettes when operating on adenoids. The former writer was fortunate enough to engage the fragment of the curette, consisting of the semicircular end of the instrument, with his finger and thus removing it from the child's naso-pharynx. The other patient swallowed the broken piece, which passed through the alimentary canal in three days without discomfort." ("American Year-book," 1902.)

PART II.

Diseases of the Pharynx.

PLATE IV.

PLATE IV.

Figure 1.—The anterior nares are dilated by the nasal speculum, exposing the inferior turbinated bodies greatly hypertrophied; the head is inclined backward

Figure 2.—Hypertrophy of the left inferior turbinated body; removal by means of the snare and transfixion-pin under cocaine or eucaine anæsthesia.

Figure 3.—Posterior rhinoscopic image, normal appearance.

1. Nasal septum, or vomer.
2. Superior turbinated body.
3. Superior meatus.
4. Middle turbinated body.
5. Orifice of the Eustachian tube.
6. Fossa of Rosenmüller.
7. Inferior turbinated body.
8. Velum palati and uvula.
9. Nasal passages between the septum and turbinated bodies.

Figure 4.—Posterior rhinoscopic image showing a posterior hypertrophy of the left inferior turbinated body.

Figure 5.—Posterior rhinoscopic appearance of a case of hypertrophic rhinitis showing:—

1. Superior turbinated body.
2. Middle turbinated body.
3. Hypertrophy and great thickening of the septum.
4. Orifice of the Eustachian tube.
5. Hypertrophies of the posterior extremities of the right middle turbinated body and of the left inferior turbinal.

Figure 6.—Pharyngoscopy.

1. Soft palate.
2. Uvula.
3. Anterior pillar of the fauces.
4. Posterior pillar of the fauces.
5. Oral tonsil.
6. Posterior wall of the pharynx.
7. Retropharyngeal abscess.

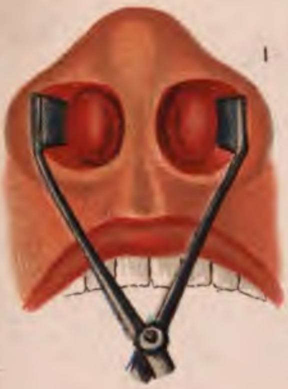
Figure 7.—Pharyngoscopy, revealing a fibromucous polypus of the nasopharynx.

Figure 8.—Laryngoscopy, showing the image of the larynx in the laryngoscopic mirror. The vocal cords are widely separated as seen during a deep inspiration. Below the white vocal cords four rings of the trachea are visible. The handle of the mirror and the towel on the tongue are cut off.

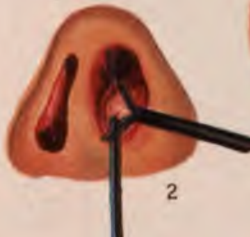
Figure 9.—The larynx during forcible inspiration.

1. Inferior surface of the epiglottis.
2. Anterior commissure of the vocal cords.
3. Cushion of the epiglottis.
4. Superior glosso-epiglottic fold.
5. Lateral glosso-epiglottic fold.
6. Cricoid cartilage.
7. Ventricular band.
8. Ventricle of Morgagni.
9. Trachea.
10. Left bronchus.
11. Interarytenoid fold.
12. Right bronchus.
13. Cartilage of Santorini.
14. Cartilage of Wrisberg.
15. Aryepiglottic fold.
16. Hyoid fossa.
17. Right vocal cord.
18. Pharyngo-epiglottic fold.
19. Superior surface of the epiglottis.

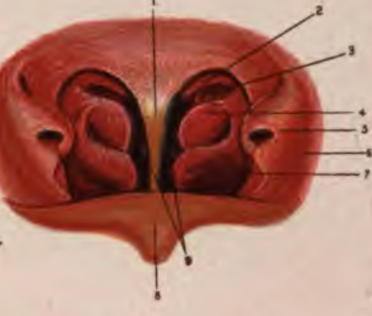
PLATE IV.



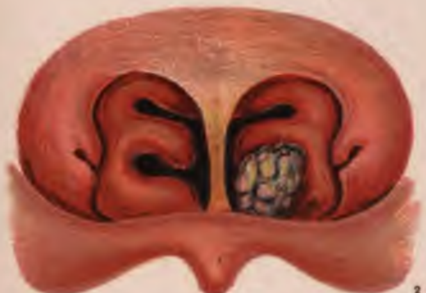
1



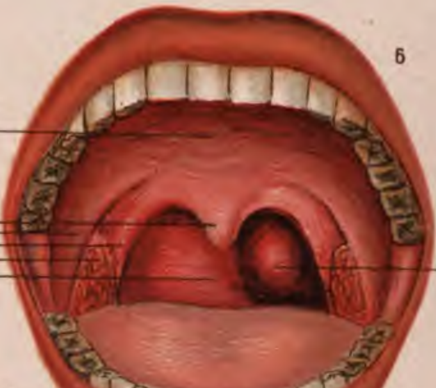
2



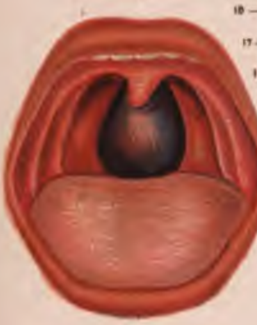
3



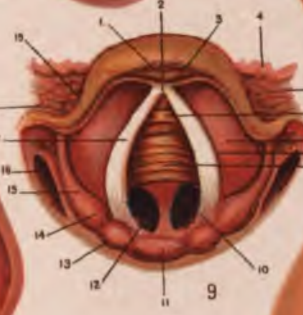
4



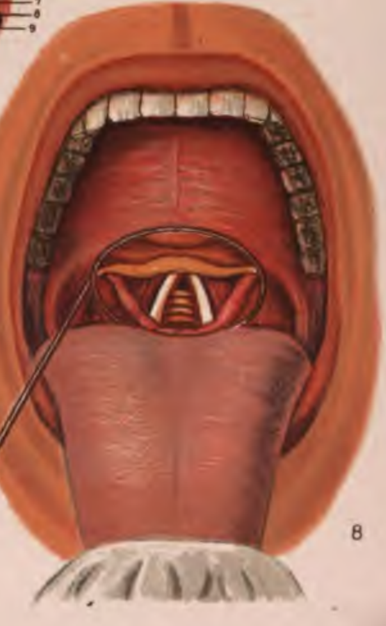
6



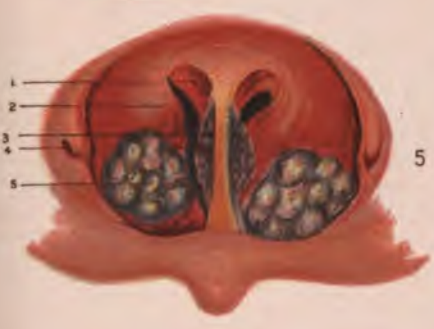
7



9



8



5

CHAPTER XI.

DISEASES OF THE PHARYNX.

Acute Pharyngitis, or Simple Sore Throat.

Pathology.—Acute sore throat may be characterized by a simple hyperæmia or an active inflammation with round-cell infiltration of the mucous membrane of the pharynx and serous effusion in the submucous tissues. The secretions contain epithelial cells, pus-corpuscles, and micrococci.

Etiology.—There is quite a wide divergence of opinion respecting the causes of acute catarrhal inflammation of the throat. There are excellent observers who deny the classical theories of taking, or catching, cold. Thorner and Fick combat the idea. But what shall we say of the common experiences of life among laymen and doctors alike? When individuals possessed of unusual intelligence and powers of observation note that certain phenomena invariably follow given causes, that exposure of certain skin-surfaces, like the back of the neck, to cold draughts of air, is regularly and repeatedly followed closely by symptoms of irritation or inflammation of the nasal or pharyngeal mucous membrane, not a few times only, but scores and hundreds of times in a long experience, shall we say that human testimony is not to be accepted, that the powers of observation are at fault, the reason clouded, and experience a delusion? Shall testimony of such a positive nature as would receive credence, and upon which a just verdict would be rendered in law, be not accredited equal weight in medicine? The logic of consecutive circumstances and events is no less forceful here than in other departments of physics.

In the case of certain subjects the exposure of the back of the neck for a short time to cold winds is just as certain to be followed by a hyperæmia or an actual inflammation of the nasal or pharyngeal mucous membrane as the inhalation of the fumes of a lighted match by a person subject to attacks of hay fever will precipitate a paroxysm of that disease. Chilling the skin of the chest by exposure to cold winds causes a reflex paresis of the blood-vessels of the bronchi or lungs, resulting in hyperæmia and congestion, or inflammation, of the lining mucous membrane. The same condition of the corresponding membrane of the nose or throat is caused in certain sensitive or predisposed persons by the chilling of the feet or back of the head or neck, but not by the impression of cold on the nose or throat directly. These causes and effects follow each other in such quick and logical succession, and are the subjects of such universal observation and experience, that one cannot ignore or resist their force.

The theory that these diseases are the result of bacterial infection may be, in some part, true, for such micro-organisms may easily enough act as exciting causes which cannot be resisted by a membrane already weakened by paresis of its vessels caused by the impression of cold; but cold is by no means held to be the only predisposing or exciting cause of acute catarrhal attacks. Streptococci and other germs have been found in the secretions in abundance, but their precise relations to the disease, cause or product, have not been determined. Acute pharyngitis occasionally follows an extensive or deep cauterization of the nasal tissues.

This affection is an accompaniment or a sequel of the exanthemata, improper use of the voice, traumatic or chemical injuries of the throat, iodism, etc. Predisposing causes are heredity, impairment of the digestive and eliminative functions, and living in overheated and ill-ventilated rooms.

Symptomatology. — The first intimation given of an attack of acute pharyngitis is a sense of discomfort in the region of the throat and more or less stiffness of the muscles concerned in deglutition, or actual pain. The temperature rises in severe attacks, especially in children, several degrees, even as high as 103° or 105° F. In mild attacks there is no fever. The naso-pharynx is frequently involved and the symptoms are proportionately extended. There are likely to be headache and symptoms referable to the ear, such as a feeling of stuffiness, dullness of hearing, and ringing in the ears. Of course, these symptoms are attributable to an extension of the inflammation to the Eustachian orifices or tubes. It is not uncommon to see the middle ear involved to the extent of acute otitis and suppuration, with perforation of the membrana tympani. The act of swallowing causes pain, to avoid which the head and neck are made to perform certain movements characteristic of painful deglutition. The voice sounds muffled and obstructed and its use is avoided on account of the discomfort produced. During the act of swallowing the food is prone to enter the post-nasal space and occasion much discomfort.

After the dry stage of inflammation has passed, the throat becomes bathed in a sticky mucus. This happens about the second day, and soon after this pus-corpuscles begin to make their appearance. The efforts to clear the throat of these rapidly accumulating discharges cause so much acute suffering that they are often swallowed, when nausea and vomiting are likely to follow. The breath becomes foul and the tongue thickly coated, indented, and flabby in severe attacks.

Early inspection shows a bright-red color of the membrane covering the fauces and pharynx. At first this is simply hyperæmic, but as exudation of serum takes place there appears a swollen, œdematous condition, especially marked in the loose tissue of the soft palate and uvula. The velum is thickened and its movements are restricted and painful. The uvula is swelled to much more than its normal size; it is elongated and feels like a foreign body in the throat, exciting frequent attempts to swallow (Plate III, Fig. 8).

The duration of this disease varies from two or three days to a week or longer. The high temperature of the initial stage drops in a day or two and remains nearly normal. It generally develops on examination that the patient has been subject to similar attacks, with a suggestiveness of periodicity. They are expected in the fall, winter, or spring, which points to the probability that there has been a predisposing chronic inflammation that requires treatment to avert future attacks.

Diagnosis.—Simple sore throat cannot always be distinguished from the sore throats of measles and scarlet fever until the eruption appears, or from tonsillitis until the glands swell. In rheumatic sore throat there is not likely to be so marked an œdematous condition of the tissues, but more pain referable to the cervical muscles.

Prognosis.—The disease lasts only about a week and is not dangerous unless it extends to the larynx.

Treatment.—If seen during the first stage of the attack it can be averted or greatly ameliorated by the administration of atropia combined with morphia in the proportion of $^1/_{400}$ grain of atropia to $^1/_8$ grain of morphia. Even in the second stage of inflammation, when serum and mucus are pouring forth in abundance, the siccative effect of these remedies lessens the secretion and the consequent painful efforts to swallow it, while their anodyne properties reduce the suffering to a minimum. The atropia antagonizes the nauseating, depressing, and constipating effects of the morphia. I have often averted these attacks in patients who had been subject to sieges of this disease with such distressing regularity that their experience was not to be ignored. Instead of suffering for a week or more, the symptoms would either disappear quietly in a few hours or cover a period of only a day or two, and with but little inconvenience.

The use of quinine, which is so common among the laity as well as among physicians, leads to serious results in numerous instances. Some families buy quinine by the ounce and keep it in the medicine closet ready for daily doses for the slightest ills. Some of the most hopeless cases of deafness I have ever met are those occasioned by the use of quinine. It is less effective and more harmful than other remedies. At the onset of an attack the patient had better go to bed, if the symptoms are severe, and take the tablets mentioned containing the atropia and morphia, or the coryza tablets, containing, each, caffeine, $^1/_6$ grain; morphia, $^1/_{12}$ grain; and atropia, $^1/_{600}$ grain. There is seldom any necessity for repeating these more than two or six times during the first two days, when the symptoms will often have disappeared. It frequently happens that one or two doses are sufficient. The effects of one dose last about four or six hours, when the patient is directed to take another, providing the symptoms begin to revive. He is never allowed to know the nature or the name of this remedy for fear of establishing a drug habit.

The bowels should be opened with a saline draught or a laxative pill. A half drachm or more of sodium phosphate is effective.

The old-fashioned sweats were quite effective, but after leaving the bed the skin is like a sensitive plant and every breath of cool air has a chilling effect, so that patients are left more liable to take cold after the sweat. Moreover, the excessive flow of perspiration is weakening.

The air of the room should be kept moist during the dry stage of the first day or two, and steam-inhalations are grateful. These are best produced by utilizing some vessel having a nozzle (Fig. 22), that may be found at hand in every house, like the tea-pots, into which a pint of very hot water is poured. Tincture of benzoin, camphor, 10 drops of pure camphor-menthol, or a few crystals of menthol are added to the steaming water, a thick napkin is wrapped about the nozzle to protect the lips, which are to embrace the tip, and this medicated steam is inhaled into the throat. It must not be too strongly impregnated with the medicaments so as to produce an irritating effect.

When both the nose and throat are suffering from an attack of acute inflammation, we have found that menthol afforded relief, especially during the dry stage, by employing it as follows: A few of the crystals are placed in a teaspoon or saucer and heated over a lamp or stove until the crystals melt and produce fumes that penetrate every part of the room. Just enough is used to medicate the atmosphere to the point of comfortable inhalation. The patient closes or covers his eyes to prevent any smarting of the conjunctivæ, and is instructed to inhale through both his nose and mouth, if nasal respiration is possible. This causes a free flow of mucous secretion that bathes and moistens the inflamed membrane and greatly relieves the sense of burning heat and dryness.

In order to obtain a continuous effect of ammonium chloride on the blood-vessels, and the soothing effect of Tolu and licorice, I have prescribed with satisfaction a tablet consisting of the following ingredients, or their equivalents:—

℞ Ammonii chloridi,	gr. j.
Tincturæ opii camphoratæ,	
Syrupi scillæ compositi,	
Syrupi Tolutani,	of each, *m.* v.
Extracti glycyrrhizæ,	gr. iij.—M.

This tablet is dissolved slowly in the mouth, and the resulting medicated saliva is kept in contact as much as possible with the inflamed membrane. During the dry stage pilocarpine can be used, if it is desired to produce diaphoresis, $^1/_{10}$ or $^1/_6$ grain two or three times during the day, or enough to produce considerable perspiration. Gargles are not very efficient, since they reach only the anterior surface of the fauces and generally produce much discomfort. Potassium chlorate has been a very popular remedy for a long time, but I have never been able to observe any beneficial effect from it, except that of a detergent in the form of a wash. The bromide of potash produces more of a sensation of relief than the chlorate in solution, and if swallowed in 10- or 20-grain doses produces a sedative effect.

The glycerite of tannin causes an exudation of serum and relieves the distended blood-vessels, besides contracting the vessels and thus modifying the intensity of the inflammation by a double effect; but the objection to its use is the necessarily disagreeable method of applying it to the throat with a camel's hair pencil or cotton-applicator. It cannot be sprayed with an atomizer without heating it to an uncomfortable temperature. After using it in my private and dispensary practice for many years I must say that it is an effective remedy if thoroughly and gently applied, notwithstanding the forcibly expressed disapproval of this remedy by so eminent an authority as Lennox Browne. By applying it several times a day the inflammation is subdued and the attack materially shortened. The author has used guaiacol in these cases, but has found different purchases to vary considerably in strength. Some specimens cause but little burning and smarting when applied pure, while others are very violent in their action and need to be diluted one-half. Patients feel relieved after the applications, particularly in case of high temperature. In some instances in which we used the pure guaiacol the membrane looked immediately after the application as if an escharotic had been used. It was covered with a light-gray pellicle, and on the following morning the mucous membrane of this area was broken down and ulcerated. There is the same objection to this that can be urged against any remedy that must be applied with a swab or probang.

Cocaine for this disease is condemned. The effect is transitory, unless one takes into account the possible after-effects of a contracted drug habit. Thorner has experienced excellent results from salol in 10- or 15-grain doses four to six times a day. It relieves the pain in both pharyngitis and tonsillitis. The writer has experienced similar results with this remedy and with salophen. The application of ice to the throat externally, which can be accomplished with an icebag (Fig. 194) and by sucking pieces of ice, if they can be relied upon as being free from disease germs, may modify and abbreviate the inflammation. Antipyrin, acetanilid, phenacetin, salophen, and aconite are useful during the fever and painful stage. After a muco-purulent discharge has formed, the antiseptic sprays, followed by the soothing, oleaginous inhalents of salol, etc., are beneficial in cleansing, disinfecting, and protecting the inflamed surfaces. (See Appendix.)

The diet must consist of very nourishing fluids, like the animal broths, beef-tea, barley- and rice- water, milk, etc. The body should be clothed according to the principles laid down in treating of acute rhinitis. One should always dress as warmly as comports with comfort.

The strong tendency of this disease to extend to the Eustachian tubes and middle ears makes prompt and efficient treatment imperative. The most effective measures for preventing or managing these complications are dealt with in the divisions on "Eustachian Tubal Catarrh" and "Acute Inflammation of the Middle Ear."

SIMPLE CHRONIC PHARYNGITIS.

Synonyms.—Chronic sore throat; chronic catarrh of the throat.

Pathology.—The condition here is essentially a repetition of the process that eventuates in simple chronic rhinitis. Frequently recurring attacks of congestion and inflammation cause a loss of tonus of the blood-vessels, which remain permanently dilated. Varicose veins stand out prominently in their tortuous courses, and the membrane remains thickened. The infiltrated tissues (Plate III) are deprived of the power of returning to their normal condition through the process of absorption because of the interruption to this process occasioned by repeated attacks.

Etiology.—Generally, simple chronic pharyngitis is the sequel of acute attacks, but it may result from the abusive use of alcoholic beverages, excessive smoking, indigestion, and torpidity of the liver. Persons exposed to a smoky, dusty atmosphere or irritating gases are especially liable to this form of catarrh. A diseased condition of the nasal membrane predisposes to this affection.

Symptomatology.—A sensation of stiffness or a parched feeling is experienced in the throat, which is only temporarily relieved by drinking. The voice is often lowered in pitch and becomes easily fatigued. Viscid masses of mucus are sometimes seen clinging to the posterior pharyngeal wall, and efforts to remove them result in explosive, scraping expulsions of the air that add to the existing trouble and set up irritation of the uvula and velum palati. These parts are thus forced into participation in the throat trouble and often are of a deep-red color and swollen and the uvula is elongated. The resulting contact of the uvula with the tongue aggravates the condition already present by provoking a cough and frequent swallowing occasioned by a feeling as if a foreign body were in the throat.

Diagnosis.—The conditions already described render the diagnosis a simple matter. It is not likely to be confounded with any other disease.

Prognosis.—This affection is annoying, but not dangerous to life, and the prospect of relief is good if the patient is willing to submit to continuous treatment for a considerable time.

Treatment.—After complete cleansing of the pharynx by the antiseptic solutions given in Chapter I, Sajous prefers silver-nitrate solution, 40 grains to the ounce. It reduces the calibre of the blood-vessels and promotes absorption. If silver is used, the strong is preferable to the weak solution. This is applied daily with cotton on a holder, with care not to let it drip or press out into the larynx. The author has found that patients experience great relief by using at home—every morning and night at first, and later, when improvement is marked, only at bedtime—a 3-per-cent. solution of camphor-menthol in benzoinol or lavolin. I have prescribed this for hundreds of patients, and they often say, many months afterward, that their improvement was so great and gratifying that they have had the prescription repeatedly filled, and have obtained the remedy for their friends. This is used with a small hand-atomizer (Fig. 11).

For office-treatment, after the cleansing throat-douche in coarse spray with sufficient air-pressure to dislodge and expel all the secretions that may stick to the membrane, we use, for a protective and emollient, benzoinol; for antiseptic and stimulant purposes, eucalyptus in lavolin, 4 per cent., and pine-needle oil in the same proportion; and, if the membrane become too dry from insufficient secretion of mucus, 90 parts of oil of cubebs with 10 parts of pure camphor-menthol. This acts as a decided tonic.

Pernicious habits must be stopped, and indigestion and torpidity of the liver overcome by proper treatment and hygiene on general principles.

Acute Rheumatic Pharyngitis.

Synonyms.—Rheumatic sore throat; rheumatic angina.

Pathology.—The pathology of this affection is the same as in rheumatism, the discussion of which belongs to the province of general medical works. The uric-acid diathesis is discussed under the heading of "Hay Fever" (page 36).

Etiology.—In persons who are subject to attacks of sore throat the acquirement of the rheumatic habit of body is likely to be followed by this type of throat affection. The attacks usually follow exposure to cold and damp.

Symptomatology.—Attacks come on suddenly after the impression of cold, and announce their presence by pain in the throat and great difficulty in swallowing. The pain of deglutition is so acute that the patient refrains from eating or even quenching his thirst. All this time there appears to be an increased secretion and flow of saliva, which necessitates frequent spitting or the alternative of swallowing. This act keeps the sufferer constantly harassed, for the movements of the muscles of deglutition cause exquisite distress, and with each act the head and neck are seen to execute certain movements characteristic of attempts to avert the inevitable painfulness of the act. While the attack lasts the suffering is greater than is usually experienced in simple acute pharyngitis, for the soreness in the rheumatic form is not confined to the mucous membrane of the pharynx alone, but exists in the muscles concerned in the movements of swallowing and even in the superficial muscles of the neck, such as the sterno-cleido-mastoid.

These attacks may not last more than a day or two, when other parts, like the muscles of the back or the shoulders, may be attacked. On the other hand, there are patients who are not conscious of ever having had an attack of rheumatism, at least an acute attack, but who are subject to periodical visitations of the typical throat affection at certain seasons of the year, either at the change from winter to spring or in the late fall.

The mucous membrane of the palate and pharyngeal wall appears of an intense-red color and has a puffy, swelled look. There is sometimes headache, accompanied with fever of a mild grade. After a few attacks those who are subject to them readily recognize their character.

Diagnosis.—The distinguishing features are the suddenness and severity of the attack, the exquisitely painful deglutition, the soreness of the cervical muscles, the brevity and shifting character of the disease, and the rheumatic history.

Prognosis.—This disease is self-limited, so far as its manifestations in the throat are concerned, for it passes off in about four days, but to return again on exposure. Prompt treatment will avert attacks.

Treatment.—Salicylic acid in some form is the most effective remedy. The author prefers a freshly prepared salicylate of sodium, and generally prescribes it in the following formula:—

℞ Acidi salicylici,	ʒiij.
Sodii bicarbonatis,	ʒij.
Elixiris gaultheriæ,	℥ss.
Glycerini,	ʒiij.
Aquæ, q. s. ad	℥iv.

Misce. Signa: One teaspoonful, in water, every two or four hours.

This is given every two hours, at first, until a perceptible improvement is shown or until the physiological effects are manifested: ringing in the ears and slight impairment of hearing. Then the doses are stopped or diminished or placed sufficiently far apart to avoid these effects. The latter are similar to those of quinine, and must be avoided as far as possible, so as not to produce hyperæmia or congestion of the middle ears or irritation of the auditory nerves. If the salicylate is not well borne, if gastric disturbance and head symptoms indicate unusual susceptibility to this drug, salicin can be advantageously substituted for it. This is best given in pilular form in doses of 5 grains, as detailed for the administration of the salicylate. In my opinion these preparations are preferable to the alkalies, guaiacum, or salol, although the latter and salophen, as well, produce excellent effects.

For the fever and pain antipyrin affords the most decided relief. Indeed, this remedy appears to exercise a special influence in quelling this disease, and is superior to phenacetin, acetanilid, etc., not only in reducing temperature, but in transcending the limited action of an antipyretic. Potassium bromide, bromidia, or morphia combined with a proportionate amount of atropia, may be called for to subdue the pain. Effervescent citrate of lithia, soda, and potash and alkalithia are indicated to rid the blood of uric acid and to prevent subsequent attacks.

As an external application, I have found the following liniment efficacious:—

℞ Olei tiglii,	ʒij.
Chloroformi,	ʒij.
Aquæ ammonii fortioris,	℥j.
Olei sesami,	℥iij.

Misce. Signa: Apply on cotton.

This is used by saturating a layer of lint or cotton, which is applied to the whole anterior and lateral aspects of the neck and then covered with a thick layer of cotton. The underclothing should always consist of wool.

CHRONIC RHEUMATIC SORE THROAT.

Synonym.—Gouty sore throat.

Pathology.—This has generally passed under the name of gouty sore throat and is due to the same causes that operate to produce various rheumatic or gouty manifestations in other organs. There is undoubtedly an increased formation and a retention of uric acid in the body, and these processes, together with their resulting morbid phenomena, are discussed at length in the chapter on hay fever (page 36).

Symptomatology. — This disease differs from acute rheumatic sore throat principally in degree. There is not acute suffering except in exacerbations of the disease, when it lapses into the acute form. It usually comes on at the same changeable seasons that excite the acute attacks, but may be present in greater or less conspicuousness throughout the year. In this case it is more troublesome during the winter months.

There is a sense of discomfort, perhaps ill defined, but annoying, in and about the throat, sometimes extending to the larynx or even to the trachea. When these lower air-passages are involved, it is often in consequence of cold, damp, chilling winds from the Northwest. Pressure over the larynx or the hyoid bone reveals tenderness and soreness of the parts, suggestive of perichondritis or periostitis. The patient is conscious of an indefinite sensation described as a constriction or an aching, which is increased by considerable use of the voice.

The laryngeal mucous membrane is not generally involved to the extent of producing hoarseness or presenting positive indications of the disease on laryngoscopy.

Diagnosis.—This disease must be differentiated from the simple inflammation of the throat and from tuberculosis, syphilis, and cancer. However, the spasmodic, intermittent, and characteristic history of this trouble ought to facilitate the forming of an opinion. The physical appearances are generally negative as compared with the malignant diseases which are distinguished by visible lesions. In the latter diseases we find the cachexia or constitutional condition indicated by the particular infection in each instance.

Prognosis.—If the rheumatic or gouty habit has not existed too long, or is not of too severe a type, the prospect of relief as the result of treatment is good. The disease is not dangerous.

Treatment. — The internal medication consists of that already described for the acute form, with the addition of a prolonged use of lithium. This remedy should be taken in appreciable doses rather than in the so-called lithia-waters extensively advertised in the newspapers. These waters often contain so little lithia according to the admittedly correct analyses that one must needs swallow the startling draught of six thousand gallons of water to get an ordinary dose of lithia. The most convenient preparation is a tablet of effervescent citrate of lithia containing 5 grains, kept dry by absorbent cotton. Two or three of these are dissolved in a large glass of water—the more water, the better—and taken once or twice a day for months in succession until the rheumatic or gouty habit is overcome. I have known of no serious disturbances following the prolonged use of lithia in this form, although I have given it over very protracted periods. A few persons are susceptible and have symptoms of strangury if too much is taken. Others do not use a sufficient quantity of water and have a slight gastric disturbance. Alkalithia and the effervescent citrate of lithia, soda, and potash are also very effective.

The sufferers from this disease, like most other people, drink too little water to dissolve the waste-elements of the body and eliminate them. We flush the sewerage system of a city to increase freedom from infection; but how much more important it is to flush the sewerage of the body and wash out the waste-products of tissue metamorphosis and prevent infection of the system by the results of decomposition! The success of the water-cures in these diseases lies largely in the amount of water passed through the body, taking up the *débris* of the tissues and dissolving out the urate of soda from the joints, the liver, and the more alkaline tissues, in which it is stored only to enter the blood when it becomes sufficiently alkaline in reaction and then to rack the body with pains.

The clothing should always be sufficient to keep the person as warm as comports with comfort, and wool is preferable to silk, for it is a more perfect protective against rapid changes of the temperature. Cotton or linen must never be worn next to the skin. The bowels must be kept regular.

If sensitive spots are detected in the throat or larynx, a 10-per-cent. solution of carbolic acid in glycerin can be applied to the painful area. By the use of this combination the local anæsthetic effect of the carbolic acid affords relief without cauterizing the tissues.

CHAPTER XII.

DISEASES OF THE PHARYNX *(Continued)*.

SORE THROAT OF MEASLES, SCARLET FEVER, AND SMALL-POX.

SORE THROAT OF MEASLES.

THE mucous membrane of the throat often participates to a large degree in the eruption of measles, and, although it generally is not severe enough to require special treatment, I have seen it so intensely involved as to necessitate as persistent efforts as the diphtheric throat. In this class of cases the mortality amounts to 80 per cent.

If the throat is examined about the time the fever appears it is found to be hyperæmic, and this condition increases to a congestion by the third or fourth day of the fever when the eruption is noted. In the membranous form an exudation occurs that closely resembles the false membrane of diphtheria. If this is removed, an uneven, raw-looking, ulcerating surface is found beneath. The inflammation and exudation cover the soft palate, uvula, tonsils, and posterior pharyngeal wall in severe cases. The swelling of these parts is great, the velum palati is paretic, swallowing is torturesome, and the tongue and general condition are indicative of a grave disease. The ulcerative process may extend deeply enough into the tissues to terminate in abscesses. Instances of Eustachian tubal catarrh and middle-ear complications are numerous.

The larynx is often invaded in measles, but generally only to the extent of setting up a catarrhal condition such as commonly affects the trachea and bronchial tubes; but, if the diphtheric form of measles affects the larynx, the outlook is a very discouraging one, for four out of five of these cases die.

Treatment.—The simple catarrhal sore throat requires treatment principally to prevent middle-ear involvement. The measures recommended for acute pharyngitis are sufficient, but the membranous form should be treated with as unremitting thoroughness as diphtheria, the local treatment for which is indicated here. (See chapters on "Diphtheria.")

SORE THROAT OF SCARLET FEVER.

As in measles, so in scarlatina, the pharyngeal mucous membrane is generally concerned, but in the simple form of the disease the throat involvement is not serious. In the severe form the membrane becomes intensely injected and of a dark-red color. Infiltration of the tissues produces swelling that is apparent to the eye on inspection, and even the neck may present a swollen appearance. The glandular bodies with which this region is so richly supplied—the tonsils and the parotid, submaxillary, and lateral cervical glands—may all be invaded by an intense phlegmonous inflammation with resulting abscesses.

The throat may be inflamed even when the eruption of scarlet fever is absent. As in measles, the swelling and œdema involve the soft palate as well as the pharyngeal walls, and suppuration and abscesses may occur if the necrotic process extend deeply into the submucous tissues. Middle-ear diseases more often result from scarlatina than from measles, and the results are far more disastrous than from measles. Suppuration of the tympanic cavities with resulting granulations, polypi, extensive caries, and necrosis, as well as a high degree of deafness, are frequently attributable to scarlet fever.

A malignant type of this disease occurs that takes on the form of diphtheria. The throat symptoms do not make their appearance until a week or longer or until the exanthem and fever have disappeared. Then the throat is attacked, the submaxillary glands swell, the throat is covered with a diphtheric membrane, a foul discharge takes place, and the breath acquires a fetid odor. The larynx is sometimes invaded, producing the croupy form of scarlatina. The glands at the angle of the jaw may suppurate, and the resulting abscesses, breaking outward, leave scars at this point.

The diagnosis is aided by the presence of an epidemic, and doubt is set at rest by the appearance of the eruption. In the membranous form culture-tests for the presence of the Klebs-Löffler bacilli should be made to determine whether or not we have to deal with true diphtheria, and in the absence of bacteriological facilities the disease, as far as the throat is concerned, at least, is to be treated on the theory that it is diphtheria.

The prognosis in scarlet-fever sore throat, if this is a prominent feature of the disease, must be guarded, for the throat affection often causes death. In the simple form it is not dangerous; but in the severe, or anginose, form about 25 per cent. die, and about 50 per cent. of the diphtheric cases prove fatal without the antitoxin treatment.

Treatment. — Aside from general treatment, which is properly left to general works on medicine, the throat should receive special attention when it gives promise of becoming seriously involved. In the first stage of the inflammation cold, in the form of an icebag (Fig. 194), may modify the intensity of the inflammation and avert or retard the tendency to suppuration. The throat-tablets and other remedies recommended in the treatment of acute pharyngitis are more effective than gargles. In the pseudomembranous form, which may prove to be a diphtheric complication, the treatment for diphtheria must be followed. Rufus P. Lincoln recommends the application of pyoktanin.

SORE THROAT OF SMALL-POX.

The pustular eruption of small-pox makes its appearance in the throat in many cases, and I have seen it extend forward to the buccal cavity. The amount of the throat eruption corresponds to the virulency of the attack. The swelling and inflammation may become sufficient to cause pain and difficulty in swallowing. The inflammation extends in many instances to the larynx and trachea, and the resulting œdema has caused suffocation and death (Plate VI).

In mild attacks there is no danger; but invasion of the larynx is a grave complication.

Treatment.—The cleansing and disinfecting sprays followed by the protective and emollient and oily preparations given in Chapter I are indicated. If the œdema extend to the larynx, scarification must be resorted to in order to prevent suffocation, and indeed it may become necessary to intubate or perform tracheotomy. In the diphtheric form resort must be had to the treatment described in the chapters on "Diphtheria."

FOLLICULAR PHARYNGITIS.

Synonyms. — Folliculous, or granular, pharyngitis; clergyman's sore throat.

Pathology.—There are two forms of follicular pharyngitis,—the hypertrophic and the exudative. In the first form the follicles are enlarged and stand out prominently upon the membrane, while in the second, or exudative, form there is a secretion of a light color, which may become dried and cheesy in consistence and appearance. In the hypertrophic condition the morbid changes are epithelial rather than follicular, but in the exudative form the follicular tubules are distended and their walls thickened, and chalky deposits are sometimes found within the follicles.

In the case of public speakers the severe tests to which the vocal organs are put increase the demands on the glandular elements to furnish an extra amount of the lubricating secretions. This protracted exercise results in increased blood-supply and deposit of nutriment, or an excess of growth of the glandular tissues, and this, together with occlusion of the apertures of the follicles, accounts for their hypertrophic condition. Irritating discharges from the naso-pharynx serve to excite inflammation in the orifices of the follicles, resulting in their constriction or obliteration.

Etiology.—It is not a simple matter to account for this disease, for it exists in young children who are not exposed to the irritants to which the disease is usually attributed: excessive use of the voice, the inhalation of dust, gases, smoke, etc. There seems to be an inherent tendency to a proliferation of cells in the mucosa. It is especially prevalent in those having the strumous diathesis. Old age seems quite exempt from this form of throat trouble, but presents the atrophic stage of pharyngitis.

Symptomatology.—In the early stage of this disease the patient complains of dryness of the throat or a tickling sensation that occasions frequent efforts to relieve, and a slight hacking cough. The voice assumes a husky quality and tires after speaking or singing a short time, and while using the voice transitory lancinating or shooting pains occur.

The dry stage is followed by a mucous secretion which is often stained with pus or blood. The discharge is usually thick and tensile, and clings to the posterior pharyngeal wall or sticks to the posterior surface of the velum. If it is not too abundant it dries into scales or crusts. The membrane covering the back wall of the pharynx is studded with several spongy, red masses, or is sometimes quite covered with them. They are in some instances punctated, appearing like little nipples; in others they have broad bases, are flat, and become coalesced in patches. Behind and external to the posterior faucial pillars their union forms a ridge extending upward and outward toward the Eustachian orifices. The blood-vessels are engorged and the veins are abnormally prominent.

The tonsils are enlarged in a considerable proportion of these cases and the uvula is relaxed and tickles the tongue (Plate III). The membrane intervening between the follicles may be atrophied and of a grayish-white color that will convey an impression, at first sight, of pus.

Diagnosis.—Cohen mentions the presence of ulcerated patches in this affection, which would render one liable to mistake this for a syphilitic throat, but I do not remember to have encountered this condition. Eliminating the question of ulcers, which must be very rare, there is little likelihood of this being mistaken for syphilis or tuberculosis.

Prognosis.—If let alone follicular pharyngitis may be expected to invade the larynx and seriously affect the voice for speaking and ruin it for singing, or it extends to the Eustachian tubes and through them to the middle ears, resulting in hypertrophic or sclerotic catarrh of these important organs. At last the history of this disease brings us to the fourth stage of throat catarrh, or atrophic inflammation, resembling atrophic rhinitis.

Treatment.—The physician does not often enjoy the opportunity of treating this disease in its early stages, for the symptoms are not urgent enough to suggest the need of medical services. As in the other inflammatory processes, cleanliness is the first prerequisite. The alkaline and antiseptic washes and the oleaginous sprays discussed in the chapter on those subjects are useful here. After perfectly cleansing the nose and throat, for this is the first step in the treatment, the follicles, two or three at a sitting, should be reduced by the application of chromic acid, London paste, or—better still—the galvanocautery. If the acid or paste is used, great caution is necessary not to let it drop into the larynx or œsophagus or spread it upon the surrounding membrane. The chromic acid is applied in the form of a bead of the crystals fused upon the platinum wire-loop applicator (Fig. 182). The London paste is applied in small particles so that they will adhere like minute spots of plaster on the surface of the follicles.

The galvanocautery (Fig. 31) is the most satisfactory means of eradicating the tumefied follicles. The long electrode is chosen according to its fitness for the particular condition present and applied to the apex or centre of the follicle before the current is turned on. Then the circuit is closed for an instant until the tumefaction is burned so as to destroy it to a point a little below the surface of the adjacent membrane. On the following day the hypertrophied tissue is seen to have given place to a gray surface that will be cast off as a slough in about a week. By repeating this process a number of times all the enlarged follicles can be dispersed. In the meantime cleansing, soothing, and protective remedies should be applied in the form of sprays, such as a 3-per-cent. solution of camphor-menthol, benzoinated lavolin, and a 4-per-cent. solution of eucalyptol in lavolin. These should be used once or twice a day, preferably at bedtime and on rising in the morning.

General treatment is demanded by a uric-acid diathesis to prevent rheumatic or gouty attacks in the throat, and if the digestion is faulty or the eliminative functions are impaired, remedies must be addressed to these conditions. The local treatment is often aided by tonics and alteratives.

MEMBRANOUS SORE THROAT, NON-DIPHTHERIC.

Synonyms.—Simple membranous sore throat; herpetic pharyngitis.

Pathology. — There occurs occasionally a form of sore throat characterized by an exudate that covers the pharynx and fauces, and extends upward and forward toward the hard palate on its inferior surface, resembling the diphtheric membrane. This is the result of an herpetic eruption in the throat, the blisters of which rupture and cover the mucous membrane with their contents.

Etiology.—The cause of this affection is not known, but it is more prevalent during epidemics of diphtheria than at any other time.

Symptomatology.—The initiatory symptoms are very much like those of diphtheria, except that they are of diminished intensity. There are chills; fever of 101° or 103° F.; rapid pulse; dirty, indented tongue; dry throat, with burning pain; and difficulty of swallowing. Blisters are often found coincidently on the lips.

In the beginning of the attack the membrane of the throat is of a deep-red color and is dotted with follicles that are inflamed or pustular in character. As these pustules rupture and their contents escape over the surrounding surface the appearance of a false membrane is given to such patches. The seat of each ruptured pustule may become an ulcer, and these grouped together present irregular areas of ulceration.

Diagnosis.—Simple membranous sore throat may be confounded with diphtheria, but it is not so grave a disease. Although it may be ushered in by symptoms simulating diphtheria and with a high fever, generally all the symptoms are of a milder grade. The simple membrane is much thinner,—indeed, one can almost discern the mucous membrane beyond,—while in diphtheria the false membrane is three or four millimetres thick and closely adherent to the surface beneath. In the simple disease the membrane is easily detached by means of cotton on a carrier, leaving a smooth surface, while detachment of diphtheric membrane reveals raw, uneven, ulcerating tissues exposed to view. Bacteriological examination in diphtheria shows the presence of the Klebs-Löffler bacillus, which is the germ of that disease, while the tests of the simple form are negative. The sputa and sections of the membrane should be submitted to the culture-tests in this or any other disease in which diphtheria is suspected. It has become an easy matter in large cities like Chicago, where there are laboratories for such purposes and the health department of the city government conducts such experiments.

Prognosis.—This disease in itself is not dangerous, but it should not be forgotten that true diphtheria sometimes is ingrafted upon it, especially during epidemics.

Treatment. — During the first stage, when the fever is high, guaiacol diluted one-half with glycerin and applied with cotton on a holder mitigates the symptoms, and is indicated on account of its effect in reducing the temperature. It is best not to use it in full strength, for it has sometimes appeared to have a destructive effect on the mucous membrane, and we have found on the day following its application an ulcerated surface corresponding to the area touched with the pure guaiacol. Hydrozone should be sprayed into the throat every few hours, the intervals depending on the rapidity with which the false membrane is formed. But it is not necessary to use it frequently if it cause much smarting and burning, for the gravity of the disease does not warrant it. If considerable pain is produced by the H_2O_2, it probably contains too large a proportion of acid and requires dilution. Ingals prefers the following pigment: Morphiæ sulphatis, gr. iv; acidi carbolici, gr. xxx; glycerini, f℥j; to which he adds 30 grains of tannin when an astringent is required. John North has stated to me that potassium permanganate will dissolve the false membrane. He uses 30 grains to the ounce of water.

Inhalations and sprays are more easily applied and cause less discomfort than swabs and probangs. I have seen much relief afforded by adding 10 drops of pure camphor-menthol to a pint of hot water for the patient to inhale through the mouth. A benzoinol inhaler (Fig. 22), an ordinary tea-kettle, small tea-pot, or coffee-pot can be pressed into service for this purpose. The nozzle is wrapped with several thicknesses of cloth, not occluding the opening itself, so as to prevent burning the lips, and the end of the nozzle is taken between the lips while the steam impregnated with the fumes of the medicine is drawn gently into the throat. This has given good results in other forms of sore throat. Carbolic acid in glycerin, of 5- or 10-per-cent. strength, will deplete the blood-vessels and anæsthetize the mucous membrane sufficiently to relieve pain. Sprays of eucalyptol, camphor-menthol, or salol in 3-per-cent. solutions—after the alkaline antiseptic sprays already given in Chapter I—have a refreshing effect.

The general treatment, diet, and hygienic and prophylactic measures appropriate to this disease are the same as those recommended in the treatment of coryza and acute pharyngitis.

CHAPTER XIII.

DISEASES OF THE PHARYNX *(Continued)*.

DIPHTHERIA.

UNLIKE the sore throats of scarlatina, measles, and small-pox, in which a pharyngeal manifestation is not a necessary element of the disease, or in which, if it exist, it is merely incidental to a constitutional malady, in diphtheria we recognize a veritable throat affection with systemic infection. The importance of the disease and the advancements recently made in its pathology and treatment warrant an extended presentation of the subject.

Since the discovery of the microbe which causes diphtheria by Klebs, in 1883, the method and nature of the disease have been illuminated by the researches of Löffler, Roux, Welch, Prudden, and others.

Pathology.—In true diphtheria there is always present in the membranous deposits in the throat a micro-organism that is not found in like exudates of other diseases. This microbe is easily differentiated from others and can be isolated and propagated in culture-tubes. When animals like guinea-pigs and rabbits are inoculated with this organism the disease which produced the microbe is reproduced in the susceptible animals. Extensive experiments and studies by scientific observers have conclusively demonstrated that this disease is one of local origin, with constitutional phenomena, depending upon the absorption of a poison generated by the specific micro-organism. The false membrane of diphtheria abounds in these microbes in its superficial layers, but they are not found in the stratum next to the mucous surface, and generally not in the mucous membrane itself. The poisonous principle evolved by this microbe is comparable to the venom of serpents, and in this connection it is instructive to observe that in contrast to this deadly microbe another is found identical with it in biological and morphological characteristics, but lacking in the power to destroy the lives of susceptible animals. This has been termed the false, or pseudodiphtheric, bacillus. Concerning the variations in the pathogenic properties and powers of these bacilli, Abbott says, in the *Medical News* for November 17, 1894: "It was observed that the genuine, virulent diphtheria bacillus was liable to fluctuate in the degree of its pathogenic properties, at times possessing these to such an extent that, when inoculated into guinea-pigs, death resulted in from thirty-six to forty-eight hours, while again the period of inoculation was much longer, often reaching five or six days, and in not a few cases organisms were obtained from undoubted cases of diphtheria that failed to give more than a temporary local reaction when inoculated into these animals."

The micro-organism of diphtheria is named the Klebs-Löffler bacillus (Figs. 75 and 76), after the scientists who have brought to light the germ that causes untold suffering and a vast waste of human life. When this bacillus comes in contact with a mucous membrane or with abraded skin an inflammation is excited. The conditions then are favorable for the development and propagation of bacilli,—warmth and moisture,—and, while the microbes themselves do not enter into the lymph or blood circulation, their poisonous product does. In this manner an infection of the whole system takes place,—a toxæmia of specific type. This poison introduced into the blood of guinea-pigs and rabbits in minute quantities produces death, and its potency is retained for long intervals in a vacuum. According to

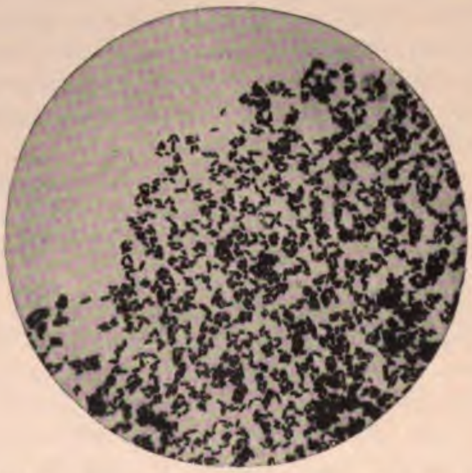


Fig. 75.—Diphtheria Bacilli. (After Krieger.) Culture on agar-agar, twenty-four hours old; stained in alkaline methylene-blue; magnified 1000 times.

Yersin and others, the bacillus itself is not virulent, but the poisonous product of the microbe is the material that causes paralysis in sheep and dogs, and death in rabbits. A similar bacillus is also found in the mouths of individuals who have never had diphtheria and who have not been exposed to it. To all appearances this is the true Klebs-Löffler bacillus deprived in some way of its virulency. It may have become modified or attenuated, but whether its poison-producing powers can become revivified is not known. These facts demonstrate that practically two diseases have formerly passed under the name of diphtheria, just as previously to the present century scarlatina and measles were supposed to be identical.

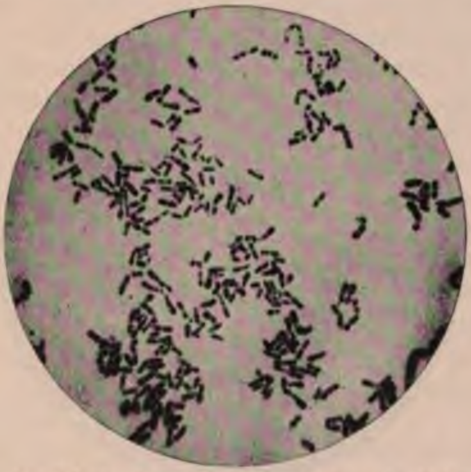


Fig. 76.—Diphtheria Bacilli. (After Krieger.) Culture on blood-serum, prepared as Fig. 75; magnified 1000 times. The short form presented in this specimen is due to their rapid multiplication. Some of the germs are distinguished by a club shape, which is considered characteristic of this species.

In true diphtheria the infection and toxæmic condition are produced by the Klebs-Löffler bacillus, but in false diphtheria this bacillus is absent or is changed in character, and in its place are found the streptococcus longus, the streptococcus pyogenes (Fig. 77), and the staphylococcus.

False diphtheria is a much milder disease than the true form and is far less frequently productive of paralysis. Although these two forms of the disease cannot be differentiated except by bacteriological methods, Baginsky, Virchow, Henoch, Smith, and others recognize the dual character of the disease. In the true form the streptococcus and staphylococcus are often found associated with the Klebs-Löffler bacillus, and even the internal organs are invaded by the cocci, where the bacilli of true diphtheria do not penetrate. The cocci have been found in the lungs and kidneys as well as in abscesses of the neck.

The bacillus of true diphtheria is possessed of remarkable vitality and may convey the disease after months and even years of latency. D'Espine and others found their potency unimpaired in cultures of sixteen months. Cases are on record in which infection occurred from clothing and other articles after as many as twenty years, and these are authenticated by observers of undoubted competency and credulity.

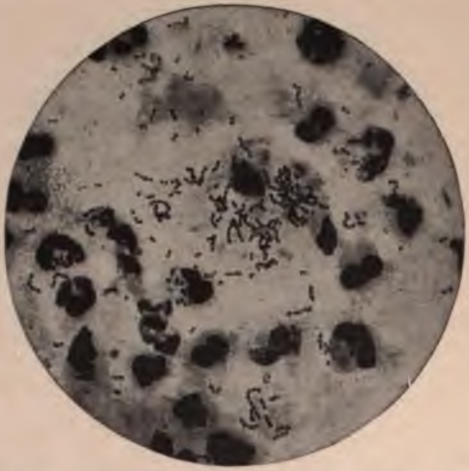


Fig. 77.—Streptococcus Pyogenes. (After Krieger.) Streptococci and leucocytes of human pus; stained in gentian-violet; magnified 1000 times (Pfeiffer and C. Fraenkel).

Diphtheria usually attacks persons under the age of 30 years, but may occur at any period of life. Its relative frequency in the very early years would almost justify the designation of a disease of childhood. Out of 1512 cases in one statistical table I find that 1309 occurred in children under 6 years and only 203 from 6 to 17 years. In another table including adults 70 per cent. of the cases were under 18 years, 20 per cent. were between 18 and 30 years, and only 10 per cent. were above 30 years. It has been observed very infrequently in infants less than 6 months old; but at this age the organism appears to be nearly immune against this disease.

The period of incubation varies greatly, there being as wide a margin as from one to twenty days. In animals directly inoculated the variation is only from half a day to three days. The sooner the disease makes its presence known, the more virulent is the type of attack. When the onset is slow and sluggish it seems to indicate either the modification or attenuation of the infecting germ or the strong power of resistance of the system.

Etiology.—Diphtheria is not a sporadic disease, since it cannot arise in a body independently of any extraneous cause. It can reproduce, but cannot produce, itself. The disease originates in any individual in the following manner: The specific micro-organism known as the Klebs-Löffler bacillus gains lodgment upon the mucous membrane or denuded skin. There it grows and multiplies, and during this development of cultures of the germ a poison is produced that is chemically analogous to the venom of serpents, and the analogy may be extended to include its virulency. The resulting pathological manifestation is a reproduction of the disease whence the infecting germ was derived. An exposure of a susceptible person to the specific microbe for only an instant may be sufficient to insure its reception upon a favorable soil; and so rapid is the process of propagation and toxæmia that a few hours—or days, at most—witness the development of this plague of nations.

Abbott, in the *Medical News* for November 17, 1894, speaking of the Klebs-Löffler bacillus, pithily puts his views in these words: "If this agent is present, diphtheria exists; if it is absent, then the local conditions and constitutional manifestations must be attributed to some other cause, and the disease is not diphtheria." The vitality of the bacillus, extending over many months or years, seems to insure the enduring nature of this decimator of communities. This is not an exaggerated characterization, for I have been in an epidemic that has literally annihilated family after family of children until the population was dazed by the devastation.

Contact of persons with those who are, or have been, suffering with diphtheria is not necessary to constitute exposure. Merely the inhalation of a patient's breath, or being in the same room, or being in the presence of one who has been in such a situation and who may carry the infection in his clothing, or handling a book between the leaves of which the germs may have found their way, may result in communicating the disease. The bearing these facts have on the use of library books and the antiquated form of kissing the Bible in courts and societies is too apparent to need expatiation.

These germs naturally harbor where millers, moths, and molds thrive most. Dark, damp, badly ventilated, and filthy places seem to be their appropriate habitat. It is commonly believed that the sewers of a city are the conveyers and distributers of this poison. Unless the sewer-traps are perfect and the sewers abundantly flushed, it is evident how the houses along the line of a sewer-system may become, one after another, the recipients of a poison entering farther up the stream. These microscopical germs are disseminated by vapors and winds and they penetrate our homes with escaping sewer-gas. This view is substantiated by the fact that the death-rate from diphtheria is twice as great in cities as in rural districts, according to our vital statistics.

The subtle nature of this microbe and its fondness for its victims and its vitality and power of propagation are suggestive of the multitudinous ways of infection and of the necessity of unceasing vigilance to escape it. One never knows when a child in school or in a public conveyance may be sitting beside a diphtheric individual, and it seems as though no argument were needed to show the absolutely dangerous character of the universal habit of kissing children, who, in fact, are much more susceptible to this deadly disease than the adults who wantonly expose them.

Surgeons have contracted diphtheria and many have lost their lives by means of a particle of the membrane or discharges from a patient's throat coughed into their eyes or upon their lips or by receiving it upon an abraded surface of the skin. When making examinations of the throat they have forgotten either to wear protecting glasses over their eyes or to keep at one side of the line of the column of air expelled by coughing.

The lower animals are subject to attacks of diphtheria. Pigeons, turkeys, and cats have communicated it to the human family in various authenticated instances. Hence the unappreciated danger of allowing children to pet and caress sick cats is apparent. Rabbits and guinea-pigs are susceptible to the diphtheric virus, and cows' milk has been known to convey this disease, as it does scarlatina.

Symptomatology. — There is a very wide margin of varieties in both the local and systemic manifestations of diphtheria. The disease may appear in a very mild form, or there may be a severe throat inflammation with distressing local symptoms and alarming and fatal constitutional disturbances. The period of incubation is generally from two days to a week, and is characterized by sensations of chilliness, waves of heat, headache, weariness or sleepiness, and depression of spirits. Following these premonitory symptoms are more pronounced ones announcing a serious involvement of the digestive and circulatory systems. Loss of appetite, nausea, vomiting, and diarrhœa occur, and are accompanied by thirst and increase in the force and frequency of the heart's action. Heat and dryness of the throat; stiffness or soreness in the muscles concerned in the act of swallowing, which is a painful procedure; and tenderness on pressure under the angle of the jaw indicate the localization of the pathological process in the throat.

The temperature rises to 101° F. in the first stage and sometimes as high as 104° F. Adults are more likely to complain of headache and backache than children. An erythematous eruption occasionally appears during the first stage. Inspection of the throat within the first few hours of the seizure reveals a reddened, swollen condition of the mucous membrane of the soft palate and tonsils. All the symptoms are not present in every case. One must expect to find some of these lacking, and a description that will accurately fit one case may vary widely of the mark if applied to the next. But we would best consider typical cases.

The second stage is that in which the false membrane is formed and the presence and proliferating powers of the diphtheria bacillus are demonstrated. The first appearance of this disease-label—which is usually within the first day or two of the onset—is a thick, yellow secretion, which can be seen covering the tonsils. A little later a yellowish-gray or a dirty, grayish-white, false membrane is seen to have made its appearance in the fauces and pharynx, increasing in thickness and extent until little can be seen but this reeking background to a painful picture. If pieces of this adventitious tissue are detached from the mucous membrane, to which it is closely adherent, the latter is seen to appear rough, raw, granular, and bleeding. All the groups of glands in the vicinity of the throat become indurated and sensitive.

The high temperature usually falls after the full development of the exudate in the pharynx, and may reach the normal on the fourth or fifth day. Decomposition of the secretions of the throat causes an offensive breath, which may often be observed the instant one enters the patient's room. The profound impression of the diphtheric virus on the circulatory system is evident from the feebleness of the pulse, which is compressible and abnormally rapid or slow. The kidneys participate in the general systemic disturbance, although the diphtheria bacillus itself does not penetrate to them; and the urine is decreased, high-colored, and rich in urea, and often in albumin also.

About the third or fourth day there may occur an extension downward of the disease into the larynx with unmistakable signs of a serious complication. The respiration is harsh and embarrassed and a dry cough reveals the hoarseness of the voice. Increasing constriction of the laryngeal cavity is evidenced by distressing dyspnœa, blueness of the lips and finger-nails, puffiness of the face, and increasing dullness of the intellect until unconsciousness and fatal coma come to the sufferer's final relief.

Other complications result from an extension of the disease to the nasal cavities, followed by a thin, yellow or dark, foul discharge from the nose, excoriating the skin about the nostrils and on the upper lip. Invasion of the nasal ducts may lead to involvement of the eyes; or extension to the Eustachian tubes may presage invasion of the middle ears with the train of consequences following in the wake of a suppurative middle-ear inflammation of a diphtheroid type.

The third stage results in resolution or death. This period of the disease begins at about the end of a week, when all the racking symptoms may gradually melt away with the loosening and exfoliation of the false membrane. The general condition shows a refreshing improvement,—a sunshine of calm succeeding a physical storm. The fever is gone, the pulse drops to the normal rate, painful swallowing disappears, desire for food returns, the kidneys and skin perform their functions naturally, and all but the strength may now return to par.

Unless a relapse occurs, or the heart has been too profoundly implicated so as to incur the liability of syncope, or diphtheric paralysis follows the attack, the patient pursues a normal course to complete recovery.

In case the infection is of an intensely virulent type and finds the powers of resistance weakened, the system yields to the irresistible invasion of the virus and succumbs to coma and death.

This is the natural history of a typical attack of diphtheria uninfluenced by the efforts of man to avert or modify its progress. Between this type and simple membranous sore throat there are great variations in the virulency of the infection and its manifestations.

Diagnosis.—Simple membranous sore throat and ulcerative tonsillitis are the most likely to confuse the practitioner in differentiating between diphtheria and other pharyngeal affections; but the exudative form of sore throat in measles and scarlet fever also closely resembles true diphtheria. The presence of a diphtheric epidemic, the rapid development of the symptoms, and the closely adherent, leathery membrane are definite diagnostic features. The membrane of the other diseases is thin and easily wiped off with cotton, leaving generally a smooth membrane beneath, instead of a rough, ulcerating, or bleeding surface. The absence of the skin-signs of measles, scarlatina, and erysipelas aid in excluding those diseases, although very exceptionally an erythematous rash occurs in the first hours of diphtheria.

From throat inspection alone it is impossible to distinguish between diphtheria and other forms of pharyngitis before either a false membrane forms or an eruption appears, so that it is then necessary to be conservative in expressing an opinion, and to treat the case as though it were expected to terminate in diphtheria.

A positive diagnosis is possible if a bacteriological examination prove the presence of the Klebs-Löffler bacillus. Other microbes may be present and embarrass the results of treatment, but the nature of the infection is established. It must not be forgotten, however, that another micro-organism identical with the Klebs-Löffler bacillus, to all appearances, is sometimes found, but differing from it in that it produces a milder affection. The disease characterized by this microbe should be termed "diphtheroid," analogously to the formation of the term "typhoid" from typhus. As soon as any symptoms exist to excite a reasonable doubt as to the possibility of the disease being diphtheria, the secretions, and especially any available false membrane from the throat, should be secured in a perfectly clean, sterilized test-tube and submitted to the microscope and culture-test by a competent bacteriologist whenever it is possible to do so. Where it is not practicable, the treatment should be conducted on antidiphtheric principles until a positive diagnosis can be rendered.

Prognosis. — This is one of the most fatal of the diseases that afflict humanity; but, in view of all the evidence adduced, it is certain that the death-rate has been reduced since the introduction of serum-therapy. Notwithstanding this, the physician should always

CHAPTER XIV.

DISEASES OF THE PHARYNX *(Continued)*.

DIPHTHERIA *(Continued)*.

Treatment. — Since diphtheria is primarily a local disease with secondary constitutional infection, in this respect comparable to syphilis, we will take up the consideration of medicinal treatment in the logical order suggested by the sequence of the phenomena that constitute its history: (1) local and (2) constitutional treatment,—both the classic method and the modern serum-therapy. But coincidently with the beginning of treatment certain preliminary precautions must be observed for the conduct of any given case to a successful issue, and also for the protection of other members of the family and the community.

In addition to observing the patient's pulse, temperature, and respiration, and other physical signs and symptoms, the throat and nose should be examined in such a way as to avoid the possibility of the physician himself becoming infected. Instead of occupying a position immediately in front of the patient while inspecting the throat he should be at one side and on the alert to dodge any of the discharges from the throat that may be expelled by a sudden, explosive cough. Otherwise a lodgment of the venomous secretion or a particle of false membrane in the doctor's eye or on his lips may cost him his life. Moreover, cases have occurred in which the expulsion of the virus has resulted in its landing in the examiner's beard or on his clothing, and the communication of the disease with deadly effect to members of his own family or to other patients. The practice of holding a small pane of window-glass between the patient's mouth and the physician's face is an excellent one.

The medical attendant of a diphtheric case would best remove his coat and vest and wear an operating-gown reaching from his neck to his feet, or, in lieu of this, a sheet pinned about his neck and enveloping his person to the feet. After the examination, his hands, face, and beard should be washed with a solution of bichloride of mercury, 1 to 10,000. The instruments used should be boiled over a very hot fire in a solution of carbonate of sodium—an ounce to the pint of water—to disinfect them. All utensils, handkerchiefs, napkins, etc., used by the patient must be treated in the same manner.

Assuming that the examination reveals the presence of diphtheria, or even a condition that excites a suspicion of that disease, the patient must at once be isolated from all except the medical attendant and the nurse. If possible, one or two rooms should be selected away from any cellar or basement, above the ground-floor and so situated as to admit the sunlight and an abundance of fresh air. All carpets, rugs, window-curtains, pictures, draperies, upholstered furniture, and unnecessary articles must be removed before the patient is admitted into this room. Without exposing the sick one to draughts of air, free ventilation should be effected from the tops, not the lower parts, of windows. The temperature should be kept uniformly at from 70° to 74° F. The body-clothing must be such that children cannot expose themselves to cold at night, and this rule should be observed also at all times, with children especially, who ought to wear union-suits by day and night-drawers at night. These consist (the first) of woolen shirt and drawers in one piece and (the second) of cotton-flannel or cotton suits made in the same way. The woolen suits are to be used in winter and the cotton-flannel for cool, and the cotton for hot, weather. The drinking-water must be pure. If there is reason for the slightest suspicion of the purity of the water it should be boiled for fifteen minutes and then chilled, not by placing possibly infected ice in it, but by setting it covered in a cold, pure atmosphere in winter or surrounding it with ice in hot weather. Pure water made cold by this means is safer than the ice sucked, as recommended by many writers, since freezing does not destroy disease germs.

The drainage of the house should be inspected to ascertain if cess-pools, stagnation, or faulty sewer connections are responsible for the sickness. All communication between the outside world and the patient must be forbidden, except through the physician and the nurse. In order that the contaminated air of the sick-room may not infect the adjoining apartments, a sheet should be saturated with a 5-per-cent. solution of carbolic acid and hung over the doorway of the chamber. A valuable antiseptic procedure is to have the bedstead, floor, and walls washed daily with a solution of mercuric bichloride, 1 to 10,000. One to 20,000 parts of water will destroy bacteria in ten minutes.

The physician's duties do not end with giving instructions. He, himself, must often insist on their observance and personally superintend or execute his own orders if he would save his patient's life. As an illustration of the indifference of the average family to the commonest sanitary regulations I will adduce a single instance: Upon being called to see a girl of 17 years, I found sufficient clinical evidence to warrant pronouncing her ailment diphtheria. She was lying in a bed in a large, but dark, damp, and musty room. On inquiry it developed that her brother and father had died of the disease in the same room and in the identical bed. I immediately asked to be shown the rooms on the floor above, and selected two adjoining apartments extending the width of the house, so that windows admitted sunlight and air on opposite sides. I directed all the contents of these rooms to be removed, excepting nothing but a bed, a table without a spread, and a chair without upholstering. Promise was exacted that the patient would be removed to these chambers without delay. On the following day I found the patient where I had left her, and worse. No time was lost in informing the family that I would at once withdraw from the case, and that I would not make another visit or prescribe for the patient at the present time unless they immediately removed her to the selected apartments. They had decided that it would inconvenience them to do so, but they hastened to comply with my demands. Thorough antiseptic measures were adopted, such as had not been employed in the cases of the brother and father. Another younger child, a sister of the patient, soon was suffering from the same disease. She was subjected to the same rigid hygienic measures. Both children recovered. One had abscesses in the neck, but no permanent bad results further than scars indicating the points of incision. Father and son died in the same room, in the same bed, with the surrounding conditions described. The two sisters recovered under conditions made as favorable as possible. Had they been kept in the dark, damp, musty, infected atmosphere of the double-death chamber, I predicted that the undertaker would soon follow my footsteps. Measures that seem imperative and even harsh may sometimes be absolutely necessary to the patient's welfare and the doctor's conscience and reputation.

It is a great advantage to have a skilled nurse to faithfully and intelligently execute the physician's directions. She will best carry out all the modern methods of care of the sick as perfected in our great hospitals. She will be prepared—as no untaught person can be—to observe the aseptic and antiseptic teachings of advanced medicine. Nothing that leaves the diphtheric patient, and that is capable of bearing infectious material, should escape a most thorough system of sterilization. Instead of napkins or handkerchiefs, cloths should be used to receive the matters expectorated, or discharges from the nose, etc., and these should be burned with the most scrupulous care that not a rag is left. The importance of this and the disinfection of sputa is plain enough when we reflect that flies are attracted to such refuse, after visiting which they cultivate the acquaintance of your susceptible nose, lips, and eyes, or any point of skin denuded of its epidermis, and there inoculate your infectious point. Cats prowl around the backyard, into which cloths soiled by the diphtheric discharges are thrown. These cats contract the disease and distribute it throughout the neighborhood. Dame Nature, in an angry mood, seems to have exercised all her cunning and ingenuity to devise unsuspected ways and intricate and invisible means for the prolific production and wide dissemination of the germs of this fatal plague of the throat. Such considerations led J. Lewis Smith to say: "The day will probably never come when we can say of diphtheria, as we can of small-pox, that it is virtually suppressed."

The sputa should be disinfected, before removal from the patient's chamber, by pouring over it enough of a solution of bichloride of mercury—1 to 1000—to entirely cover the discharges. This should remain in the receptacle at least a half-hour and be agitated several times to bring all portions of the ejecta into contact with the disinfectant. Deodorizing and disinfecting medicaments are volatilized in the room, much to the patient's comfort. I have observed excellent effects from melting menthol crystals in a teaspoon over a flame until the air was comfortably impregnated with the fumes. When the nose was involved I have taken the hot steaming liquid to the bedside and held it where I could blow the fumes over the bed toward the patient's face so that he would inhale a considerable quantity of them through both the nose and mouth. His eyes are kept closed, and if not too great heat is used so as to make the fumes too dense, without any irritating effects, his nose and throat are benefited. If the throat is entirely covered by a thick membrane, of course no fumes reach the mucous coat beneath. J. Lewis Smith prescribed as a prophylactic the fumes of the following prescription: ℞ Olei eucalypti, acidi carbolici, of each, ℥j; terebinthinæ, ʒviij. "Add 2 tablespoonfuls of this mixture to 1 quart of water and allow it to simmer constantly, near the patient, in a vessel with a broad surface, as a tin or zinc wash-basin, a vessel with a broad surface being needed so that it will not take fire. The vapor produced is strong and penetrating, but not unpleasant."

Local Treatment.—There are remedies that exert a solvent action on the false membrane when the latter is macerated in them for a considerable time, and this fact has led to their use as gargles and local applications by means of swabs and sprays. Some of these remedies have too slow and feeble an effect to be of efficient use in the throat. Others exert a decided and perceptible influence in dissolving the exudate both without and within the body. Such, for example, is sulphocalcin, to which my attention was first attracted by William C. Wile several years ago, at a meeting of the Mississippi Valley Medical Association, to which he reported a large series of diphtheric cases in which unusual success had attended the topical application of this remedy. I then introduced it into my practice, and am able to confirm Wile's statement of the solvent properties of this preparation. In a letter recently received from the doctor he reaffirms his previous statements, and says his experience during the intervening years has been as satisfactory in the use of the drug as his first reports indicated.

My method of employing the liquid is as follows: Absorbent cotton is twisted firmly on a long cotton-carrier curved at the roughened end so that it is impossible for the pledget to drop off into the throat. This is dipped into the fluid and pressed against the side of the small container, which should have a wide mouth. After pressing out all the surplus so that none will squeeze out and run down into the larynx, the medicated cotton is brought into contact with all the surfaces of the false membrane, making sure that the latter is wet with the sulphocalcin. The cotton is then burned. This treatment is repeated as often as is necessary to keep the membrane dissolved and the throat clear of it. At first it has sometimes been necessary to have the nurse apply it every fifteen minutes, lengthening the time between the treatments, as the membrane becomes less rapidly formed, to a half-hour, an hour, or two or four hours. When no false membrane reappears the remedy is discontinued. The solvent effect of this treatment is so apparent that I wonder at its not having come into more general use. Its disagreeable odor is an unfortunate feature. John North informs me that a 30-grain solution of permanganate of potassium will dissolve the false membrane.

In the *British Medical Journal* the lamented Lennox Browne spoke of sulphurous acid as being an efficient germicide that acts systemically as well as locally with good results. I have often applied the sulphocalcin pure, and always do when the false membrane is thick enough to prevent the remedy from coming into actual contact with the mucous surface; but, when the exudate is reduced to such a state of thinness as to allow the drug to penetrate to the mucous membrane beneath, it is necessary to dilute it with water until the smarting and burning otherwise produced is reduced to the point of toleration. But, the stronger it can be borne, the better the results.

Hydrozone, or dioxide of hydrogen (peroxide, H_2O_2), has proved very effective when it could be used in full strength with an atomizer. I have used large quantities of hydrozone during the past few years with great satisfaction. It is one of the best of disinfectants and antiseptics. When a spray of the fifteen-volume strength is made to copiously cover the false membrane it immediately begins to foam. As it comes in contact with pus-corpuscles they are decomposed and oxygen is liberated to destroy the micro-organisms present. The mechanical effect of the process of effervescence appears to make the false membrane more friable, to loosen it, and to aid in its removal. It is best to spray an abundance of the fresh preparation into the throat while the tongue is depressed, so as to reach every part of the pharynx. Then the patient, if old enough, is directed to hold it in the throat and gargle it so that contact is prolonged. Gagging should be avoided for fear of producing vomiting and the loss of much-needed food. The tongue-depressor must not be carried far enough back on the base of the tongue to cause retching. This treatment has proved very effective in my experience, and is repeated every half-hour, or every one, two, or four hours, as the conditions demand. It is of prime importance that the hydrozone be strictly pure, fresh, and just opened, and not allowed to be exposed to the air, heat, or light. If the pure hydrozone cause too much smarting, it can be diluted.

For some years before sulphocalcin and hydrozone were introduced I used lactic acid in a steam-atomizer. It appeared to have a beneficial action in softening and loosening the false membrane. It was a favorite remedy with Lennox Browne, who applied it pure once or twice a day and had the nurse make applications of a dilution, 1 to 6, every two or three hours. It is to be pressed into the false membrane with a cotton swab. This cotton-applicator should always be used instead of a brush, for the latter is sometimes laid aside and forgotten only to be used at some future time and add more sorrow and deaths to the account of diphtheria. Such instances are on record. When pieces of the diphtheric membrane are macerated in pure lactic acid outside of the body it becomes "soft, translucent, and jelly-like."

There is one objection to all applications that must be made with swab, brush, probang, etc. In the case of fighting, struggling children these methods probably do more harm than good by exhausting the little patient's strength.

I have used the purple, or blue, pyoktanin, but am not satisfied of its value. From my experience with a 10-per-cent. solution of carbolic acid in glycerin in other diseases I am led to believe that its germicidal and local-anæsthetic effects would be valuable here. Lime-water irrigations and sprays have but little effect on the false membrane, but the direct fumes of slaking lime are beneficial, as even steam alone tends to soften and loosen the membrane. The lime-water makes the membrane more friable, but not thinner. I could never see any satisfactory results from potassium chlorate except simply as a cleansing solution. Salicylic acid is highly recommended by some Europeans, but is not in favor with Americans as a local remedy. I have no experience with it in diphtheria, but the results of trials with it for similar purposes in other diseases are not reassuring. Insufflations of powdered sulphur are much used by the laity, but I have seen no benefit, though much misery, from them.

Tearing off the pseudomembrane and cauterizing the mucous membrane is to be deprecated. Its forcible removal is justifiable only when it amounts to an actual obstruction to respiration. It should be borne in mind that the bacilli are not in the layer next to the mucous membrane, but in the superficial layers. Generally they are not found to have penetrated to the mucous membrane,—a fact that seems to have been lost sight of by those physicians who aim to penetrate the deeper layer of the false membrane in order to inject remedies into the mucous tissues beneath, which opens up an avenue for the penetration of germs to the blood- and lymphatic vessels.

J. Lewis Smith reported excellent results from the following prescription for topical application:—

℞ Acidi carbolici,	gtt. x.
Liq. ferri subsulphatis,	fʒiij.
Glycerini,	f℥j.
Aquæ puræ,	f℥ij.

Löffler (*Deutsch. med. Woch.*, October 18, 1894) gave to the Buda-pest Congress his formula for toluol for the local treatment of diphtheria. It consists of alcohol, turpentine, and 2-per-cent. phenol (proportions not given). Since then he has used the following formula: Alcohol, 60 volumes; toluol, 36; liq. ferri chloridi, 4. In 71 cases in private practice he had no deaths; adding 30 cases in hospital with 5 deaths makes a mortality of 4.9 per cent.

The local applications of toluol "should be begun early, should be thorough, and should be repeated every three or four hours until the temperature sinks to normal, which usually occurs in from twenty-four to forty-eight hours. Afterward three times daily and continued as long as any membrane is present."

Löffler claims that if this application is used often enough and thoroughly the disease does not spread and has not invaded the nose or larynx in any case so treated. Intense pain followed the application, so "20 volumes of menthol were added, making: menthol, 20 volumes; toluol, 36; absolute alcohol, 60; liq. ferri chloridi, 4."

When the nose is invaded, a spray of dioxide of hydrogen, 1 part in 5 or 10, if it smarts, or Dobell's alkaline antiseptic solution, the formula for which is given in the appendix, should be sprayed into the nose until it is cleansed. Then the nares are cleared by blowing or by cotton on the small carrier (Fig. 115), and aristol is insufflated by means of the small powder-blower (Fig. 83).

Cold applied continuously to the throat with icebags (Fig. 194) retards and modifies the intensity of the inflammatory action of the first stage, but, after the false membrane begins to separate, continuous heat is indicated. The hot applications may be better borne than the ice in the first stage, and if the cold appear to produce much discomfort and irritation the heat should be substituted therefor. Water as hot as can be comfortably borne may be used in the same rubber bags.

Acids retard the proliferation of micro-organisms, and for that reason lemon-water and cold water acidulated with the acid phosphate or dilute sulphuric acid are of service and grateful to the patient. If the sulphuric acid is used it must be taken through a glass tube and must not be allowed to come in contact with the teeth on account of its deleterious action on the enamel. Frozen milk and beef-tea cool the throat, quench the thirst, and support the strength. Barley- and rice- water are to be recommended in the same way and for the same reasons.

Internal Treatment.—The patient should be persuaded to take milk in preference to water for quenching the thirst and for the sake of maintaining the strength. Insistence may need to be resorted to for the sufferer's good. When the strength begins to wane alcoholic stimulants are necessary to bridge over the period of exhaustion and consequent collapse. Whisky, sherry-wine, or diluted alcohol in emergencies are generally to be preferred. Stimulation and alimentation by enemata may be required when swallowing is impossible or the stomach rejects everything. Preparations of predigested foods, peptonized meat, etc., can be injected into the bowel per rectum through a large catheter extending well up toward the sigmoid flexure.

Tonics are indispensable in severe cases. Quinine and iron are the favorites of most physicians unless heart-failure is impending, when strychnine is employed. Tincture of the chloride of iron is given in large doses every two hours, proportioned to the patient's age. It is best combined with glycerin, as, for example, in Billington's formula: ℞ Tincturæ ferri chloridi, fʒj; glycerini, aquæ, of each, f℥j. Mercury in the form of the bichloride and the mild chloride has for a long time been in high repute with the profession both in Europe and America. The corrosive sublimate is used in solution—1 to 10,000—locally, and considerable doses in the form of pills, etc., are also given internally. The calomel is administered internally and by sublimation. Internally it is given in doses of $^1/_2$ to 3 grains every two hours until the bowels move freely, and then the doses are placed at sufficient intervals to not weaken the patient by catharsis. When the membrane is discharged, the calomel is discontinued. I. N. Love used sodium benzoate in doses of 5 to 15 grains. Guttmann and others claim good results from pilocarpine, but its depressant action on the heart and the bronchorrhœa it produces render its efficacy at least questionable in a disease with a natural tendency to heart-failure and respiratory obstruction. In case of enfeebled heart-action full doses of strychnia are indicated.

Treatment for laryngeal invasion will be found in the division on the larynx (page 271).

Apartments occupied by diphtheric patients must always be thoroughly fumigated with sulphur as soon as recovery takes place. Dry fumigation is not sufficient. In order effectually to destroy disease germs the air must be kept moist during the process of fumigation.

Paralysis of the larynx, pharynx, velum palati, and lower extremities and loss of the tendon reflexes are sequels of diphtheria.

Strychnine in large doses, especially subcutaneously injected; central galvanization; and local faradization have given the best results in overcoming these paralyses.

The antitoxin, or blood-serum, therapy, already mentioned, is considered in the following chapter.

Intubation is treated of under a separate heading (page 273).

CHAPTER XV.

DISEASES OF THE PHARYNX *(Continued).*

DIPHTHERIA *(Concluded).*

SERUM-THERAPY IN DIPHTHERIA.

BEHRING, Kitasato, Roux, Ehrlich, Martin, and others have found, as a result of their experiments, that if the blood-serum of animals that have been deprived of susceptibility to a certain disease be injected into other animals, it deprives the latter, in turn, of susceptibility to that disease, and modifies or aborts the disease if it be already present. Rabbits and guinea-pigs are employed in these experiments. If the serum from one of these animals previously immunized against diphtheria or tetanus be injected into another susceptible one, the latter is protected from the disease for a time.

The method of procedure is these experiments is, briefly, as follows: Enough of the poisonous product of the disease is injected into an animal to sicken it, but not to cause death. Small hypodermic injections of diphtheria cultures and toxins are given at first and gradually they are increased as the tolerance of the animal increases. As this process proceeds the blood of the injected animal acquires gradually increasing immunizing powers. The injections are followed by local tumefaction and fever. At intervals a quantity of blood is taken for the purpose of experimental tests on other animals to determine its efficacy. After the latter is shown to be sufficient, a large amount of blood is taken from the animal, placed in vessels on ice to produce coagulation, and the separated serum, mixed with $^1/_2$ of 1 per cent. of carbolic acid, constitutes the serum remedy. On account of their susceptibility and size, goats and horses are employed to obtain this serum in large quantities. An enormous amount of this is produced in Germany. Behring says: "The works can now supply one hundred thousand doses a month, which barely keeps pace with the demand from Europe and America."

The benefit to be derived from the antitoxin injection depends largely upon the time in the history of the disease at which the remedy is employed. If three or four days or a longer time has elapsed, so that the disease has invaded the larynx or bronchial tubes, and the profound toxic effects of the diphtheric poison are manifested in the heart, nothing may save. If the building is nearly consumed by fire, water cannot save it. However, the patient should always be given the benefit of a doubt and the remedy that promises the most hope must be used.

The German physicians report a large saving of life by the use of the serum-therapy. Roux, of Paris, claims similar results. It is asserted that the serum itself is harmless, and some deaths that have followed immediately upon the injections may have been due to other causes, such as the syringe penetrating a vein and injecting air, or heart-failure, etc. Other deaths may have been caused by the accidental introduction of some other material of a septic nature. The varying results apparent in the statistics of different observers and hospitals are likely affected to a considerable extent by a difference in the virulence of the several epidemics and of different cases in the same epidemic.

The serum injections are made in the loose subcutaneous tissue, generally below the axilla or between the shoulder-blades, after preparing the skin by washing with soap and a bichloride solution, 1 to 1000. The antitoxin of Behring comes in hermetically sealed flasks or vials bearing labels that indicate the doses contained. Each vial contains one dose, as follows: No. 1, 600 immunizing units, to be used on the first or second day of the attack; No. 2, 1000 units, for serious cases on first or second day or in mild cases of longer duration; No. 3, 1500 units, for adults or severe cases in children. If one injection does not prove effective, it is repeated after twenty-four hours.

As a prophylactic, smaller doses are given. For children, 100 to 200 units are sufficient. The length of time this dose affords immunity is not definitely known, but it is safest not to allow more than three weeks to elapse with a child still exposed to the disease without a repetition of the protective dose.

We will now consider the results of the blood-serum therapy.

"Professor Behring delivered a recent address on this subject in which he replied to the swarms of critics who have been attacking him the past year or so. He maintained that statistics prove the efficacy of the serum, and that the 60,000 deaths from diphtheria which the German empire has averaged each year will be found to be reduced to 40,000, and a more general use of the serum would reduce this to one-third. Throughout the city of Berlin the fatality in diphtheria amounted to 30 per cent., but in the Contagious Hospital, where serum was promptly used, the mortality was only 20 per cent. In the same time in 1895 it was only 10.3 per cent. The mortality in the hospitals had always been much greater than outside heretofore. Last year the percentage of mortality in diphtheria cases in Berlin fell to 15 per cent. During this period the disease was not a mild form, but averaged more morbid symptoms than at any time since 1886. During the first three months of 1894, when the serum was not to be had, there were 363 deaths per 1000, while the last three months, when everybody could get the serum, there were 198 deaths per 1000."

"Kossel, speaking for Koch and of the results obtained in the Institute for Infectious Diseases at Berlin, declares that no uncomplicated case that was treated in the first or second stage of the disease was lost, and that the mortality of all cases was reduced to 16 per cent." (Sajous's "Annual of the Universal Medical Sciences.")

The use of antitoxin is highly extolled by the French. M. Monod claims that its use has decreased the mortality from diphtheria 65 per cent., and it is claimed that by its use 15,000 lives have been saved in France.

As to the effects of the serum on the course of the disease, according to the experience of Dr. Kitasato, of Japan, the points to be noted are: "1. The fall of temperature; in many cases the defervescence was almost critical, and it takes place usually at the end of from twenty-four to forty-eight hours. 2. The separation of the false membrane, which takes place, as a rule, after the return of the temperature to near the normal. Very large casts of the trachea and larger bronchi have been coughed up. 3. Urticaria-like eruptions were observed in very many cases, being, in some, quite severe and annoying. They, however, disappeared in a few days without any treatment. 4. In 4 cases marked albuminuria was observed at the time of admission. In these cases albumin disappeared from the urine in the course of the treatment. Pyrexia was accompanied by albumin in the urine, but there was no reason to believe that any renal trouble was caused by the injections. 5. Five cases developed paresis of the soft palate. Microscopical as well as culture examinations were made in every case, and Dr. Kitasato's report of 26,521 cases deals with those cases only in which Löffler's bacilli were demonstrated to be present." *(Journal of the American Medical Association.)*

Regarding the accidents following injections of antitoxin, and referring to the death of Professor Langerhans's child, Edwin Klebs, late Professor of Pathology in the Chicago Post-graduate Medical School, says: "The good effect (of serum-therapy) in the first two days of diphtheria seems to be doubtless." Referring to the Atlanta meeting of the American Medical Association, he continues: "I remarked the dangerous effects in some rare cases, as that of Professor Langerhans. Now the papers bring the notice that the death occurred by the introduction of stomach-contents in the bronchi. I do not know if that is acceptable, possibly post-mortal. I wished to point out the problem to get the antitoxin substances in a purer form, so that all possibility of infection may be avoided." In his discussion at the meeting referred to, Professor Klebs said: "Now I come to a point that seems to me to be of the highest importance,—the danger of antitoxin. I wish that point would be illustrated in a more extensive manner by publishing all cases in which the injection was shortly followed by death. We have such cases, but a part of them seems to be on account of the disease. But if in one case alone the patient has been killed by antitoxin, we have a great interest to find out the true cause of the death. Such a case is that of Professor Langerhans, in Berlin. After a girl in the house became diphtheric, he thought he would, if possible, prevent the spreading of the disease to his own children; but after the injection the first child died immediately. So it is possible that death may occur after the most cautious injection of antitoxin,—a fact that gives a high responsibility to every physician using this remedy. We must search, therefore, to find out what may have been the cause of such fatal accident.

"In this case it is reported that the body of the dead child was quite normal, well nourished. There was no introduction of air into the blood. The danger of introducing air is, by the way, not so great as often accepted. One can inject some centimetres of air in the blood-vessels of a rabbit without any bad effect, as the air is resorbed in a very short time. It will be better to inject the fluid in children into the muscles far distant from the lungs,—the dorsal or gluteal region. Then it is convenient to push the needle alone in first and see if bleeding follows or not. If not, one may inject without fear, but always slowly, under no high pressure. If these precautions are followed, I think that no danger can be feared from the injection.

"I think it is not probable that the antitoxic serum itself contains such a formidable heart-poison, as very great quantities of it injected into the peritoneal cavity of animals prove harmless. Much more probable it seems to me, that in this and other similar cases observed in Brooklyn, N. Y., an accidental pollution of the antitoxin has combined with intravenous injection to produce fatal effect.

"The sure disinfection of serum is a very difficult matter. Twice I have found microbes in tubercle serum. On the other side, the best antiseptics—as mercury bichloride, phenol, and kresol—make coagulations in the serum. Therefore, one must search for other disinfectants that will not coagulate albuminous matters. I note that chinosol is proclaimed as such by Emmerich; its antiseptic action is forty times stronger than carbolic acid and it does not coagulate albumin. I have proved it a very good disinfectant for external and internal use, and I would recommend it for the disinfection of serum. Certainly we must demand from the manufacturers of antitoxic serum that they must prepare the serum in an absolutely pure manner, excluding totally the possibility of accidental pollution. It is not a good manner to dispense it in colored bottles. It can be protected against the light by dark coverings.

"I am sure that all these precautions can be executed and will be executed in this land, in which I have seen as good bacteriological work as anywhere in Europe."

In another letter, dated December 1, 1897, Professor Klebs writes, among other things: "My opinion is that we must have the antitoxins from the cultures and that we need not use more serum." He refers to a paper which he read at the meeting of the American Medical Association in 1897, in which he states that "In the serum there must be contained not only antitoxic, but also bactericidal, principles. It is, therefore, most probable that not only antitoxic, but also bactericidal, principles work together to produce the curative effect of the serum. Furthermore, these bodies are not new products formed in the immunized animal, but transformed from the injected culture-fluid. This leads to the possibility that we are able to transform the culture as such directly, without the passage through the body of an animal, and my experiments in this line seem to emphasize this theory."

In the case of the sudden death of Professor Langerhans's child, the official report says "that previous to the fatal injection the child had taken dinner, followed shortly afterward by some milk and cake. Death took place during a severe fit of coughing, and the necropsy showed that the trachea and bronchi were entirely filled with a gray substance, which was proved by microscopical examination to consist of particles of food, a good deal of the same being still present in the stomach. The uvula was swollen. The medical experts declare, therefore, that the child died from suffocation. They are of the opinion that the boy vomited after the injection, and that, being in a fainting state from the pain of the injection, he was not able to get rid of the vomited matter, but drew it into the larynx in the act of inspiration. They did not find any embolus of air in the pulmonary artery, as was suggested, nor was there any confirmation of the opinion that death had occurred by syncope. According to the statement of the Control Office, the serum was of normal quality."

The medical press in November, 1901, reported 20 cases of tetanus, with 13 deaths, in St. Louis, attributed to diphtheria antitoxin prepared by the Health Department of that city. A large horse had been under treatment for the production of antitoxin for nearly three years, had been bled a number of times, and had furnished over 30,000 cubic centimetres (30 quarts) of the antitoxin. The greater part of the antitoxin distributed by the Health Department during the years 1900 and 1901 came from this horse. On October 2d the horse was taken sick with tetanus and was killed. The last serum was taken from him on September 30th, and the first of the series of tetanus cases, which resulted from the use of his serum, was reported on October 26th, 1901.

At the coroner's inquest on the deaths mentioned above, the assistant bacteriologist of St. Louis testified that "the infected diphtheria antitoxin used was not tested on guinea-pigs before its distribution by the department. The serum was intrusted to a negro janitor in the city chemist's office; some of the bottles were not labeled, and the janitor was the only person who could distinguish them."

Great vigilance should be exercised by the bacteriologists who are charged with such a responsible trust. In the Health Department of Chicago all of the antitoxin used or distributed by its members is tested. "Out of each installment received in the laboratory, 5 per cent. is tested on guinea-pigs previously injected with diphtheria toxin; if the animals survive without untoward symptoms or undue reaction, the installment is accepted as of the antitoxic strength indicated on the label of the package. Obviously, if the serum contained the tetanus bacillus or other pathogenic germ, that fact would be developed in the test. No such result has ever followed during the six years' use of this remedy by the department, but on three occasions installments have been rejected for failure of the indicated antitoxic strength." (*Journal of the American Medical Association*, November 23, 1901.)

Reports of health commissioners of various cities give the results of the serum-therapy as follow: In New York City the death-rate was reduced by antitoxin from an average of 33.93 to 21.16 per cent.; Indianapolis, from 26.29 to 13.36 per cent.; St. Louis, in 1894, with no antitoxin, the death-rate was 28.2 per cent.; in 1895 the death-rate among those treated with antitoxin was 8.4 per cent. The Chicago Health Department reported in May, 1896, a reduction from 52 to 9 per cent.; Boston, from 50 to 16. The Kaiser and Kaiserin Hospital, of Berlin, reports a reduction from 50 to 10 per cent., and the Willard Parker Hospital shows a mortality of only 10 per cent. under serum-therapy *(New York Medical Journal)*. In the Boston City Hospital the reduction in the death-rate was from 42 to 17 per cent. In the *Johns Hopkins Hospital Bulletin* W. H. Welch shows that, in 814 cases in which the serum was used before the third day, the percentage of deaths was only 5.5 per cent.

Dr. Arthur R. Reynolds, Commissioner of Health of the City of Chicago, wrote to me under date of November 13, 1897, as follows:—

"Answering your queries concerning the antitoxin treatment of diphtheria by the Chicago Department of Health, I submit the following:—

"1. Since October 5, 1895, when this treatment was begun by the department, and up to the close of last month, October 31, 1897, a total of 4658 cases of alleged diphtheria were reported to the department for investigation and treatment. Of this number 3982 cases were bacterially verified as true diphtheria, and in 3759 cases the antitoxin was permitted to be used, with the following results:—

Total cases treated	3759
Total cases recovered	3514
Total cases died	245

Death-rate, 6.51 per cent.

"Among those treated subsequently to March 31, 1896—records of intubations prior to that date are imperfect—there were 145 intubations, with 121 recoveries and 24 deaths. Death-rate of intubated cases, 16.53 per cent.

"There were also treated with immunizing doses of antitoxin

2631 cases of persons exposed in infected families, of which number 16 were subsequently attacked with the disease, but all recovered.

"As bearing upon the question of treatment with relation to age of patient and reported day of disease when first antitoxinized, the following are the figures of 1391 cases treated during the last twelve months—November 1, 1896, to October 31, 1897:—

RESULTS OF ANTITOXIN TREATMENT IN BACTERIALLY VERIFIED DIPHTHERIA.

DAY OF DISEASE WHEN FIRST TREATED.	TOTALS, BY AGES.				RECOVERED, BY AGES.				DIED, BY AGES.			
	Under 1 year.	1 to 5 years.	5 to 10 years.	Over 10 yrs.	Under 1 year.	1 to 5 years.	5 to 10 years.	Over 10 yrs.	Under 1 year.	1 to 5 years.	5 to 10 years.	Over 10 yrs.
First day . . .	26	76	54	33	26	75	54	33	0	1	0	0
Second day . .	45	155	112	71	41	153	110	71	4	2	2	0
Third day . . .	32	168	120	77	31	157	113	73	1	11	7	4
Fourth day . .	32	97	60	45	30	89	58	42	2	8	2	3
Later than fourth day .	20	74	61	33	11	57	50	25	9	17	11	8
Totals	155	570	407	259	139	531	385	244	16	39	22	15

"There were 92 deaths in the 1391 cases treated: a mortality-rate of 6.61 per cent.

"With reference to reported day of disease when first treated, there were 189 treated on the first day, with 1 death: mortality-rate, 0.53 per cent.; 383 on second day, with 8 deaths: mortality-rate, 2.06 per cent.; 397 on third day, with 23 deaths: mortality-rate, 5.79 per cent.; 234 on fourth day, with 15 deaths: mortality-rate, 6.41 per cent.; and 188 first treated later than the fourth day of the disease, with 45 deaths: a mortality-rate of 23.92 per cent."

Since Reynolds introduced the use of antitoxin in the Health Department of Chicago in 1895 the productions of Behring; Roux; Parke, Davis and Company; Mulford, and others have been employed. Four grades are now used, as follow:—

Grade No. 3A.—Vials contain 5 cubic centimetres, 150 antitoxin units (Behring's standard) to each cubic centimetre, or 750 units.

Grade No. 4.—Vials contain 5 cubic centimetres, 200 antitoxin units (Behring's standard) to each cubic centimetre, or 1000 units.

Grade No. 5.—Vials contain 5 cubic centimetres, 300 antitoxin units (Behring's standard) to each cubic centimetre, or 1500 units.

Grade No. 6.—Vials contain 5 cubic centimetres, 400 antitoxin units (Behring's standard) to each cubic centimetre, or 2000 units.

The department has issued a circular of information, which contains such important advice, of practical value, that we will quote briefly from it: "It is apparent that preparations of antitoxic serum which contain a large amount of antitoxin to each cubic centimetre are more desirable than those containing a smaller amount, since the dose required is proportionately less, and disagreeable symptoms, which sometimes follow injections of the larger quantity of the weaker serums, will be avoided. The highest-grade preparations, however, are much more difficult to produce, are necessarily more expensive, and at present, even with approved [improved?] methods, can be produced only in limited quantities.

"The average curative dose of diphtheria antitoxin is about one thousand (1000) units; but for very severe cases, or croup cases, or those in which the serum is not administered until the third day or later, fifteen hundred (1500) or two thousand (2000) units are often required, and sometimes the dose must be repeated; so that altogether from four to six thousand units may be required in a single case. Full directions as to the use of the serum accompany each vial.

"From one hundred (100) to three hundred (300) units, according to age, are required to confer immunity. The immunity thus produced ordinarily lasts for a period of at least four weeks. With the new and strongest preparations of antitoxic serum, only very small quantities of the serum (from 6 to 15 minims) are necessary for the production of immunity."

The Health Department reports that no serious symptoms have resulted from the antitoxin itself: "There have been some local pain at the seat of the injection (just above the crest of the ilium), some swelling and redness, urticaria following from three to ten days after its use, but in no case were the sequels one-half so painful or so formidable as the mildest sequences of successful vaccination. There have been a few cases of albuminuria a few days after the use of immunizing doses of antitoxin, but these have been very transitory and soon pass away, with complete recovery—never any serious consequences; while, in all cases of marked albuminuria resulting from diphtheria, the renal symptoms rapidly subside after the administration of antitoxin of the proper strength and quantity. Albuminuria from antitoxin has not been observed since we have been using the higher powers of antitoxin with smaller amounts of serum. Not only that, but careful experimentation has convinced us that albuminuria came from the large use of the serum and not from the antitoxin itself, and the same may be said of other sequels. The effect upon the diphtheric infection is most remarkable: at once arresting the disease if used in the early stages and properly administered, and giving excellent results even when used after the fourth day, although this cannot be so confidently expected as when the antitoxin is used early."

The use of antitoxin in the Cook County Hospital, Chicago, was begun in July, 1895, and was continued under the charge of D. D. Bishop, W. L. Baum, and A. C. Cotton. The results were published by H. A. Brennecke, who says: "According to the various statistics, the mortality of diphtheria before the use of the serum is placed at about 40 per cent. Since the serum has been used in the Cook County Hospital the mortality, as is shown by the tables, has been reduced to 12.5 per cent." (*Medicine*, January, 1898.)

The following letter was in reply to a request for the results of the antitoxin treatment of diphtheria by the health officers of Chicago:—

City of Chicago

Department of Health

ARTHUR R. REYNOLDS, M.D.
COMMISSIONER

February 13, 1903.

SETH SCOTT BISHOP, M.D.,
Chicago.

DEAR SIR:

Accompanying this please find, in response to your request for the present percentage of mortality in diphtheria treated by the Medical Inspectors of the Chicago Health Department, a copy of the January, 1901, *Bulletin*, which gives in detail the results in the treatment of 5727 cases of bacterially verified diphtheria between October 5, 1895, and December 31, 1900, with a mortality of 6.79 per cent.

To these should be added 557 cases treated in 1901, with 35 deaths, and 639 cases treated last year (1902) with 26 deaths, making a total of 6923 consecutive cases of true diphtheria—bacterially verified as such—during 87 consecutive months, with a total of 450 deaths, making a death-rate of 6.49 per cent.

Of the gross total, 673 were laryngeal diphtheria requiring intubation, and 192 of these died: a mortality-rate of 28.52 per cent. of intubations.

Of the total 639 cases treated last year, with a mortality-rate of 4.06 per cent., 50 required intubation, and 12 of these died: a mortality-rate of 24 per cent. of the intubated, and of 4.12 per cent. of the remaining cases.

Trusting these figures may serve your purpose, I am,

Faithfully yours,

ARTHUR R. REYNOLDS.

A critical review of the great mass of evidence accumulated, both favorable and unfavorable, to the blood-serum therapy, a small fraction of which is here presented, forces the conclusion that the preponderance of evidence justifies the verdict that diphtheria antitoxin, administered early and in sufficient doses,—the first or second or not later than the third day of the disease, has the power to prevent a fatal issue. Given later it may modify the intensity of the toxæmia if a multiple of the ordinary dose be given.

Mixed infection, and invasion of the larynx demanding intubation or tracheotomy, lessen the chances of recovery.

While the serum is a powerful remedy and may be capable of doing harm, the disease itself is so virulent that, in view of the great weight of testimony and statistics in favor of the antitoxin, the physician should not fail to avail himself of this addition to thorough local and general treatment.

CHAPTER XVI.

DISEASES OF THE PHARYNX *(Continued).*

TONSILLITIS.

UNDER this heading it is convenient to treat of acute inflammation of the tonsil and of the peritonsillar tissue.

Synonyms. — Quinsy; amygdalitis; phlegmonous sore throat; angina tonsillaris; ulcerative tonsillitis; suppurative tonsillitis; abscess of the tonsil.

Pathology.—This is an acute inflammation of one or both tonsils. There are three principal varieties: (1) simple catarrh, (2) ulcerative tonsillitis, and (3) abscess of the tonsil.

Some authorities distinguish five varieties of this disease, but practically they are all variations of three types of inflammation. The inflammatory action may be of a mild catarrhal character and limited to the mucous membrane, or it may eventuate in superficial ulceration, or it extends to the submucous tissues, with infiltration of the whole gland and the peritonsillar connective tissue. In the second and third forms the lacunæ, or crypts that indent the surface of the tonsil, are filled with micrococci, pus, and epithelium.

Tonsillitis is most frequent in persons between the ages of 15 and 30 years, and especially among those of a rheumatic habit and with hypertrophied tonsils. The inflammation usually involves to a greater or less degree the pillars of the fauces and uvula. They are red and swollen and the uvula elongated and troublesome (Plate III). The attack may terminate in resolution, ulceration, abscess, or hypertrophy. In the case of an abscess it may rupture near the superior and anterior portion of the tonsil in the vicinity of the arch of the soft palate. The orifices of the crypts may become obstructed, with the result of distending these cavities with the pent-up secretions.

With regard to the bacteriology of tonsillitis, it cannot be said, at the present time, that the various forms of tonsillitis are caused by any special organism, although they may be traced to a microbic infection. A. Veillon (*Archives de Médecine*, March, 1894) concludes that "pathogenic microbes may be found in all forms of non-diphtheric tonsillitis. The streptococcus pyogenes virulens was present in the twenty-four cases examined, and was usually associated with the less virulent pneumococci and sometimes with staphylococci. The streptococcus appears to play the most important rôle in all cases. The different kinds of tonsillitis are of the same nature. The clinical and anatomical differences depend upon (1) whether the organisms affect the surface of the mucous membrane, its deeper layers, or the subjacent cellular tissue, and (2) the virulence of the microbes and the resistance of the subject."

Etiology.—While tonsillitis is not usually met with in persons younger than 15 or older than 30 years, I have seen it above the fiftieth year. No age is absolutely exempt. In my opinion, rheumatism is an important factor in the production of this disease. A close relationship is often observable between attacks of tonsillitis and rheumatism, one following or preceding the other—one subsiding as the other develops. Cold, damp, foggy, or changeable weather is a predisposing cause; the presence of hypertrophy and the history of previous attacks presage future ones. Unusual exposure is a frequent excitant of this as it is of other inflammations. The crypts are often found filled with caseous masses that excite inflammatory action. These cheesy plugs undergo decomposition and become acrid, irritating, and foul-smelling. Acute tonsillitis occasionally follows nasal cauterization.

Symptomatology.—Premonitory symptoms are: a heavy feeling akin to exhaustion, followed by a sense of feverishness, headache, and pain in the back and legs. Chilliness may be present during the first few hours and the temperature may rise to 103° or 105° F. by the second day. If the fever is very high it indicates that the deeper structures are likely to become the seat of an abscess. As the disease progresses, the tonsil becomes swollen and obstructive to deglutition; sensations as if a foreign body were in the throat, together with increased secretion of mucus, occasion frequent efforts to free the throat by swallowing, which becomes more and more difficult. All the surrounding tissues may participate in the inflammation in the severe type so that the velum and uvula are red, thickened, and sensitive. The elongation of the uvula to the extent of constant contact with the tongue (Plate III) adds to the excitants of painful deglutition. When the inflammatory action extends to the orifices of the Eustachian tubes and to the pharyngeal tonsil, impaired hearing, noises, and even pain in the ears ensue. These symptoms represent the crisis of the simple catarrhal form of a severe character, and now begins an abatement of the inflammation, subsidence of the pain, swelling, difficult swallowing, and the membrane begins to assume a more natural color.

In the second, or ulcerative, form, instead of an amelioration of all the symptoms at the crisis of the inflammation, the mucous membrane softens and breaks down in spots. The surface of the gland is dotted with small, yellowish-gray points (Plate III) that coalesce and form irregular ulcers covered with a muco-purulent discharge. I have known physicians to mistake this coating of the ulcers for a diphtheric exudate, but the deposit can be seen at first as limited to the orifices of the lacunæ, and there is a wide difference between the two, even in macroscopical appearances.

When the inflammation extends to the deeper structures speech is seriously interfered with, and it is difficult to articulate with sufficient clearness to be understood. The mouth cannot be opened on account of the pain and tumefaction about the angle of the jaw, and it may be well-nigh impossible to examine the pharynx, even with the aid of the forehead-mirror and tongue-depressor (Plate III). In this stage cold sweats and sleeplessness are sometimes experienced. Liquids regurgitate into the nose or find their way into the larynx, occasioning most violent fits of coughing and strangling. The cervical muscles sometimes become sore and tender on pressure. The continuous exertions necessary to clear the throat of secretions, which are not swallowed, but allowed to slaver from the mouth, serve to increase the distress. When the uvula can be seen, it is found clinging to the affected tonsil. While the secretion of saliva is increased, the urine is diminished in quantity and of high color. The breath becomes freighted with a fetid odor and the tongue is furred with a yellowish-gray coat. The bowels are generally constipated.

Mild attacks of tonsillitis may not extend beyond a week, but the severe form, which terminates in an abscess, is a tedious type. In the course of a week or ten days a chill denotes the formation of pus, and a little later, if the abscess is not opened, it breaks, usually in the throat. However, it may rupture externally at the angle of the jaw, or burrow underneath the cervical muscles, forming an abscess of the neck, or it may gravitate to the thoracic cavity.

Diagnosis.—The characteristic symptoms described render the diagnosis comparatively easy. There is not much likelihood of confounding this disease with any other but diphtheria. In the latter disease the tonsils are not always swollen, and the false membrane is thick, leathery, and of much lighter color generally. Yet it must not be forgotten that the Klebs-Löffler bacillus is sometimes found in the throat when there is no false membrane; so that in suspicious cases a bacteriological examination should be made. In the sore throat of measles and scarlet fever the distinguishing rash, the ease of opening the mouth, and the comparatively little enlargement of the tonsils clear up any doubt. Syphilitic sore throat does not present the intense group of symptoms of severe tonsillitis, and can be differentiated from the mild catarrhal form, in that fever and pain are generally absent and the difficulty of swallowing is not so prominent a symptom. Patches of redness, instead of the bright, diffused, red glow of acute tonsillitis, characterize the early stages of syphilis, while the secondary stage is manifest in the mucous patches and skin eruptions, and the tertiary stage in the deep ulcerations and an unmistakable history.

Prognosis. — Simple catarrhal tonsillitis usually terminates in resolution, running a course of about a week. It is often preceded or followed by a rheumatic attack of other structures, and may end in tonsillar hypertrophy. Ulcerative tonsillitis also tends toward recovery, but the possibility of invasion of other parts, such as the Eustachian tubes and tympanic cavities, emphasizes the necessity for efficient treatment. Occasional deaths have occurred from tonsillar abscess emptying into the larynx or causing laryngeal œdema. The occurrence of an abscess lengthens the attack to two or three weeks and sometimes longer.

Local Treatment.—Local applications of glycerin of tannin have proven effective in the simple catarrhal tonsillitis. I am aware of the opposition to this treatment by high authority (Lennox Browne), but one cannot ignore years of actual satisfactory experience with it. The writer has made it a practice to apply this remedy with a very soft, bushy camel's hair pencil every two or four hours. If there is considerable pain, a 10-per-cent. solution of carbolic acid in glycerin will afford a local anæsthetic effect, besides depleting the vessels and acting as an antiseptic. I have found local applications of guaiacol useful. It appears to shorten the attack. If the pure drug is painful, it can be diluted one-half with glycerin. Gargles of alum-water and potassium bromide in 4-per-cent. solutions are grateful in some cases. Much refreshing relief is experienced after copiously spraying the throat with benzoinated lavolin or a 3-per-cent. solution of camphor-menthol (Figs. 11 and 12). The author's throat-tablets also have given excellent satisfaction. Each tablet contains the equivalent of the following formula:—

℞ Ammonii chloridi,	gr. j.
Tincturæ opii camphoratæ,	
Syrupi scillæ compositi,	
Syrupi Tolutani, ... of each,	min. v.
Extracti glycyrrhizæ,	gr. iij.

These are allowed to melt slowly in the mouth, so as to prolong the contact of the remedies as much as possible with the inflamed membrane. C. E. Bean recommends a compound rhatany lozenge, consisting of 2 grains of extract of rhatany, $^1/_6$ grain of extract of opium, and 18 grains of currant-paste.

Ulcerative tonsillitis should be treated with alkaline disinfectant and antiseptic topical applications. Frequent sprays of hydrozone, Dobell's and Seiler's solutions, glycothymolin, listerin, pasteurin, borolyptol, etc., will cleanse and disinfect the glands, after which a covering of aristol should be given with the powder-blower (Fig. 83). A 10-per-cent. solution of silver nitrate applied to the ulcerated surface hastens the cure.

If an abscess is threatened by the severity of the symptoms, local cold should be used early by means of an icebag (Fig. 194) directly over the tonsil. As soon as an abscess can be discerned it should be opened instead of waiting for nature to accomplish this. Several days of extreme wretchedness will be spared the sufferer by this means. The knife should have a handle sufficiently long to not hamper one in his movements. The cutting edge must be kept toward the median line so as to avoid wounding the internal carotid artery, which might occur by a sudden movement of the patient if the cutting edge were directed toward the artery. The abscess usually points near the arch of the anterior faucial pillar. R. C. Myles injects a few drops of a 4-per-cent. solution of cocaine into the tissues before incising them (*The Laryngoscope*, February, 1898).

For phlegmonous tonsillitis Gouguenheim (*Lyon Médical*, 1894) recommends Leiter's coil around the throat, leeches to the angle of the jaw, 20- to 33-per-cent. cocaine painted in the pharynx, irrigations with warm boric-acid solution, and salol or naphthol internally for an intestinal antiseptic.

Tonsils that are subject to recurring attacks of inflammation should be guillotined (see division on "Tonsillotomy"). Kitchen excises the tonsil to abort an impending attack of quinsy, and to prevent future attacks.

Constitutional Treatment.—When the pain is severe and swallowing difficult, I have seen the most gratifying relief attend the administration of a combination of morphia with atropia in the proportion of $^1/_8$ grain of morphia to $^1/_{600}$ grain of atropia. This remedy relieves pain and irritability, checks the excessive secretions that constantly excite efforts to swallow, and modifies the intensity of the inflammatory process. Patients to whom I have administered this for the first time, and who have been in the habit of passing through similar attacks for years, have remarked with unfeigned gratitude that they had never before received such relief from suffering during a siege of their malady. A laxative should be given at the onset of the attack, so as to open the bowels freely. Aconite enjoys quite a reputation in this disease, given in doses of 2 or 3 drops every half-hour. Potassium bromide, mentioned in connection with local treatment, has a beneficial sedative effect if some of it is swallowed after gargling with it, so that 10 grains every two or three hours are taken.

The rheumatic character of this affection calls for such remedies as salicylic acid and antipyrin. If there is no reason why salicylate of sodium should not be given, it is to be preferred. When it is well borne the writer gives 10 grains every two hours until the symptoms become ameliorated or slight physiological effects are produced. A freshly prepared solution should be used, for example, as follows:—

℞ Acidi salicylici, ...	ʒiij.
Sodii bicarbonatis, ...	ʒij.
Elixiris gaultheriæ, ...	℥ss.
Glycerini, ...	ʒiij.
Aquæ, ... q. s. ad	ʒiv.

Misce. Signa: One teaspoonful, in water, every two hours.

If salicylate of soda disagrees with the stomach or causes ringing in the ears, salicin should be substituted in pilular form, 5 grains to be taken every two or four hours.

Antipyrin in doses of 5 or 10 grains every three or four hours not only relieves pain, but possesses especial efficacy in rheumatic affections.

Salophen and salol, given in effective doses early in an attack, will subdue the inflammation and apparently prevent the formation of an abscess. They should be administered in 5- or 10-grain doses every two to four hours, at first, according to the age of the patient and the severity of the attack.

HYPERTROPHY OF THE TONSILS.

Synonyms.—Enlarged tonsils; chronic tonsillitis; follicular tonsillitis.

Pathology.—Hypertrophy of the tonsils is a true hyperplasia, according to Virchow, in which all the glandular elements participate in the proliferous process. The increase and induration of the connective tissue is manifest in some tonsils at the time of excision, by the resistance to the passage of the guillotine through them, but in most instances they are yielding and sponge-like. The crypts are expanded and their walls are tumefied. Instead of a tenacious mucus filling the cavities there are often cheesy masses of a light-yellow color sometimes mixed with calcareous concretions. There is an increase in size and usually in number of the follicles surrounding the depressions. Norris Wolfenden (*Journal of Laryngology*, etc., August 18, 1894) reports the results of studies in follicular tonsillitis as follow: "Follicular tonsillitis is a desquamative process in the crypts of the tonsils, the follicles taking no part in the process and only exhibiting a secondary hypertrophy, as recently maintained by Sokolowski and others. There are other forms of infective tonsillitis associated with the exudation of fibrin, the presence of streptococci, staphylococci, and pneumococci."

In the follicular, or lacunar, tonsillitis the pseudomembrane shows staphylococci and streptococci and the pseudodiphtheric bacillus. It cannot always be distinguished from diphtheria except by bacteriological examinations.

Krückmann (Virchow's *Archiv*) confirms Hanau and other observers in the view that the tonsils are the portal of entrance for tubercle bacilli in cases of tuberculosis of the cervical lymphatic glands.

In this connection it is interesting to note that in the tissue of the floor of the mouth have been found the staphylococcus aureus, streptococcus, diplococcus, and certain bacilli, probably the bacillus septicus or the bacillus œdematis maligni of Koch and Pasteur. Probably Ludwig's angina arises secondarily from a streptococcic infection of the glands, and affected teeth or bones may be an important etiological factor in both diseases.

Etiology.—Hypertrophied tonsils are found in the very young so commonly that they may be spoken of as being congenital, but in many instances they develop about the age of puberty. The largest number of cases are seen between the ages of 10 and 20 years, the next largest under the tenth year, and those occurring between 20 and 30 years are next in frequency. After the thirtieth or fortieth year tonsillar hypertrophy is rather infrequent, for their growth ceases and the process of atrophy sets in about the thirty-fifth year. Nearly twice as many males are affected as females.

The rheumatic habit; living in a damp, cold atmosphere; recurring attacks of inflammation, the throat complications of the eruptive diseases, diphtheria, syphilis, and the strumous diathesis are all productive of those conditions that predispose to an increase in the volume of these glands. After the thirty-fifth year I do not advise the removal of the tonsils unless there is some special reason for it, since their gradual diminution in size and tendency to inflame date from about this period of life.

Symptomatology.—The features of a child with enlarged tonsils often present a picture which suggests at once the nature of the trouble. Previously to an examination of the thrôat one is often able to predict the condition to be found. The under-jaw drops, the mouth remains continuously open, the eyelids droop, and the face is expressionless and suggestive of a dull intellect (Fig. 71). During sleep the respiration is noisy and of a snoring character. Associated with hypertrophied tonsils in a large proportion of children so affected will be found an enlargement of Luschka's tonsil, or adenoid vegetations in the vault of the pharynx. In these associated diseases with obstruction to the current of air through the nose by adenoids and the backward projection of the oral tonsils, and to the passage of air through the mouth by the blocking up of the fauces with the oral tonsils, the oxygenation of the blood is seriously interfered with. The effects on the voice are readily apparent. The resonance of the nasal cavities is so diminished that speech has a thick, unnatural nasal quality, and the articulation of words is impeded and difficult (Plate I).

The tonsils are situated in such close relationship to the Eustachian orifices that any disease of these glands threatens impairment of the integrity of the Eustachian tubes and middle ears. While the tonsils are not so situated as to produce actual pressure upon the tube-mouths, as was formerly supposed, any inflammatory action affecting the gland readily extends by continuity to the tubal membrane. The large number of patients with hypertrophied tonsils who suffer from middle-ear diseases is suggestively significant. Mackenzie and others speak of defective smell and taste in tonsillar hypertrophies. Great embarrassment of the respiration may interfere seriously with the general health, and in very young persons, or those with a tendency to rickets, the chest-walls may become deformed, resulting in pigeon-breast, or a pyriform deformity.

Inspection of the throat reveals the tonsils tumefied (Plate III) and in some instances so enormously enlarged as to lie in contact with each other and to cut off a view of the posterior wall of the pharynx. They are generally very red, soft, and yielding, and can be crowded through the fenestra of a tonsillotome so small that it would seem impossible.

Diagnosis.—A view of the pharynx under good illumination is sufficient to establish the diagnosis. There is a possibility of mistaking an enlarged tonsil for a pharyngeal abscess, but the chances are remote. The location of the tonsil and, if necessary, palpation with one finger on the tonsil and another over its base under the angle of the jaw, would distinguish the location and character of the tumor (Plates III and IV).

Prognosis.—Probably the vast majority of hypertrophied tonsils are never removed or even treated, yet it is the exception to find them after the thirtieth or fortieth year. This means that there is a natural reduction to the normal size after adolescence or middle life. However, there are many individuals with impaired hearing that is attributable either directly or indirectly to the presence of tonsils that have been subject to repeated attacks of inflammation. In adult life I rarely advise their removal unless they are provocative of some disturbance, for in many they occasion no inconvenience. But I have seen persons in middle life who were subject to so much suffering from attacks of quinsy that they sought relief by excision. It must not be forgotten that the lacunæ of the tonsils, from twelve to eighteen in number for each gland, afford nests for the reception and culture of micrococci that may give rise to more serious trouble. These depressions are sometimes very deep, plunging down into the parenchyma of the gland, and form an ideal incubator for the development of micro-organisms. There are warmth, moisture, decomposing secretions, and a harbor from the currents of air or friction of fluids and food that might otherwise dislodge them.

Treatment.—Iodine internally, astringents to the surface of the tonsil, and injections of various drugs into the body of the gland are recommended for its reduction, but they are all inane makeshifts that worry the patient without benefit to any one but the doctor. The tonsil should be removed in its entirety. My aim has always been to cut it clean off at the base so as to get below the bottoms of the crypts and leave a smooth surface for the stump.

Tonsillotomy.—Before operating for excision of the tonsil the throat should be sprayed with an antiseptic wash, such as dioxide of hydrogen or mercuric bichloride,—1 to 10,000,—to remove or destroy any microbes that may be present. We rarely apply cocaine or eucaine, for the reason that it is not a very painful operation. The gland is not freely supplied with nerves of sensation. But in very nervous individuals it may be necessary to employ a weak solution for the purpose of a placebo. Occasionally I have been obliged to use the bromide of ethyl, removing both tonsils and adenoids during one anæsthesia.

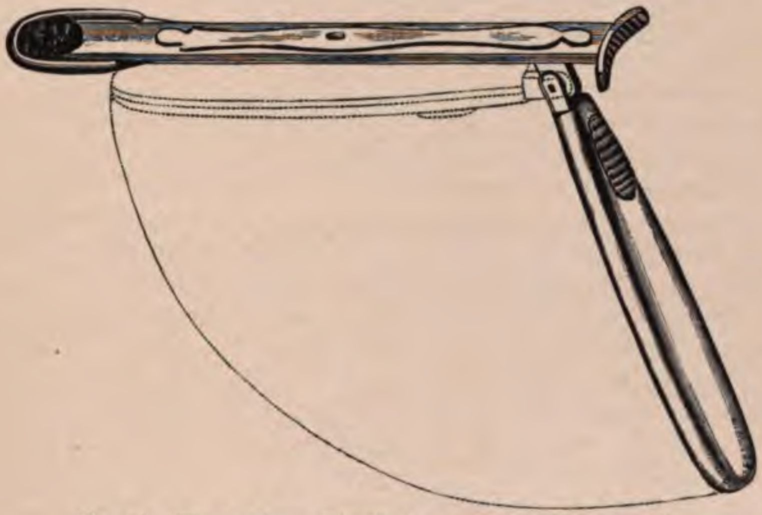


Fig. 78.—The Author's Tonsillotome, with Excised Tonsil.

The patient, if a young child, is seated on the lap of an assistant or a nurse. One arm of the latter pinions the arms of the child, and with the other hand the patient's head is held back against the nurse's shoulder by pressure on its forehead. A convenient method is to infold the child in a sheet, which is made to fix immovably the arms and legs (Fig. 73). Now the tonsillotome (Fig. 78) is introduced into the mouth like a tongue-depressor, then turned to one side with a movement that causes the ring of the opening to surround the tonsil. Sufficient pressure is then exerted to cause it to embrace the tonsil at its base. An assistant should press with his thumb or finger upon the side of the neck just over the base of the gland so as to prevent it from receding from the instrument. This counter-pressure need not be great, but simply sufficient for support. As the instrument is pressed into position, the operator's thumb drives the blade through the gland until the cutting edge of the guillotine rests between the ring-plates. This act completely severs the tonsil and secures it between the bevel of the knife and the upper ring-plate. Care must always be taken to cut the tonsil clear through before withdrawing the instrument.

Tonsillotomes.—Any physician who has had a considerable experience in tonsillotomy with the various tonsillotomes will not be likely to deny that these instruments are generally too complicated. They are armed with needles, barbs, or sharp-toothed forceps for piercing the tonsil and dragging it through the fenestra before any cutting is done by the blades. A tonsillotome constructed after the pattern I have designed renders the barbs unnecessary. It reduces the painfulness of the operation by one-half; it divests the procedure of any danger of an accident to the operator or patient; it makes a skillful and easy operation possible with a minimum amount of experience; it resembles a large, folding tongue-depressor so closely that children usually offer no opposition to its introduction for the removal of the first tonsil; and it combines strength and compactness with simplicity of construction. It is made on the principle of a guillotine, the blade of which is propelled by the thumb of the same hand that grasps the handle. The latter is set at such an angle to the shaft as will permit the most perfect co-ordinate action of the muscles of the hand and arm of the operator. I have had two sizes manufactured, the smaller having a fenestra of the calibre ordinarily found in such instruments, the other supplied with an aperture larger than the largest Mackenzie tonsillotome, while it is so compactly constructed as to require less space in which to operate. I have used the larger size to extirpate enormously hypertrophied tonsils in children as young as $2\,{}^1/_2$ years, where it was impossible to insert the Mackenzie instrument of the necessary size. The smaller one is sufficient for the majority of cases, but the fenestra is not capacious enough to admit the bases of the extraordinary glands we occasionally see. It is advisable to remove the whole tonsil, and, as the tops only of the largest tonsils can be severed with the smaller instruments, it may be better to have the larger size, if but one is to be kept.

The blade is so protected as to make it impossible to wound the ascending pharyngeal or the internal carotid artery. The shaft that propels the blade is of such a width as to make the use of a gag unnecessary, for it protects the finger of the operator from the patient's teeth, if it is placed in the mouth to ascertain when the fenestra is in such a position as to embrace the whole tonsil, as it is necessary for one to do when operating in children with other tonsillotomes. Since I have used this guillotine I have not had my finger bitten, while it was not an uncommon occurrence, before, to come off second best so far as pain was concerned. With the shank wide enough to afford protection, it is unnecessary to introduce the finger into the mouth, for the teeth and lips cannot close enough to prevent the operator from seeing plainly the field of operation. There is no working in the dark or fear of damaging structures one does not wish to attack.

The handle is firmly fixed to the shank with a hinge-joint and self-acting spring-lock; so that the fenestra can be pressed down about the base of the gland with any degree of power required. This feature dispenses with any necessity for hooks, forceps, needles, or barbs for spearing the tonsil. The latter, being a soft, fleshy mass, adapts itself to the shape of the fenestra and protrudes through it the instant its base is pressed around. The pain of spearing or tearing the tonsil by toothed or barbed accessories, designed to drag the gland through the fenestra before the blade cuts, excites the most vigorous struggling and resistance on the part of a child. Even when the utmost care has been exercised, the barbs have pierced the soft palate or the surgeon's finger, instead of the tonsil. Moreover, the gland always comes out with this instrument, the same as though barbs were used. There is another important advantage in having the handle attached to the shank with a hinge provided with an automatic lock, for the cutting extremity of the instrument cannot be thrown out of your control by a disturbance of the coaptation of its parts. The last time I operated with a Mackenzie tonsillotome the child jumped just as I was placing the fenestra about the tonsil. The shank revolved upon the handle, leaving the latter in my hand, while the cutting-end was entirely displaced and removed from the vicinity of the gland. It is impossible for this improved tonsillotome to play such a trick. The handle contains a concealed spring-lock operated by a convenient thumb-plate. When this is moved downward, the hinge-joint is unlocked and the instrument folds upon itself like a pocket-knife, occupying the space of about one and one-fourth inches in width and thickness by six and one-half inches in length. Another pertinent point, that should not be neglected in this age of antisepsis, is the provision for cleansing and disinfecting the three pieces of which the instrument consists. By raising the proximate end of the horizontal top spring of the shaft and swinging it 90 degrees to either side it becomes disengaged from its lock and liberates the blade from the shank. This arrangement makes it as simple as possible for taking apart, sterilizing, and putting together again.

In amputating the apex of a relaxed and elongated uvula the blade is inverted. It is claimed by some operators that the remnant of the tonsil will become atrophied if its apex only is clipped, but I have never been able to find a good reason for half-doing the operation. I have never seen any but healthful results from ridding the throat of the whole trouble at once.

There are cases in which one may be in doubt as to whether the gland ought to come out or not, because there is but slight hypertrophy, and the appearance of the throat does not seem to warrant surgical interference. But those same glands may be honeycombed with deep, slit-like crypts that are packed with inspissated, decomposing, irritating, caseous secretions that start the attacks of sore throat that make the patient's life a burden.

It is a good rule never to part with the patient until one is sure that all oozing of blood has ceased. I have seen a few cases of very severe hæmorrhage, but as a number of such instances are on record we must always be alert for them. In the case of a student at the Illinois Medical College, a young man of 24 years, I had my first experience with profuse hæmorrhage from this procedure. After I had operated on a number of children during the clinic and had sent them to the treatment-room to wait until all signs of bleeding ceased, the student requested me to operate on one of his tonsils. On examination I found it only slightly hypertrophied, and remarked that I did not generally remove glands so little enlarged. However, he insisted that he had suffered all his life from recurring attacks of inflammation, and was anxious to part company with the cause of them. Thereupon I excised it, but was struck with the very unusual amount of resistance offered to the cutting blade. It seemed like forcing it through creaking leather.

As the student left the operating-chair I proceeded with my remarks to the class as follow: "The hæmorrhage has entirely ceased in all the children and they can now go to their homes. I have removed a large number of tonsils in the various clinics and in private practice without seeing a case of persistent hæmorrhage. We have never had to resort to measures to stop the bleeding. It generally ceases within five or ten minutes spontaneously. But in case of severe hæmorrhage, what would you do? Excellent remedies are to be had in a saturated solution of tannic acid in water; an ice-cold gargle; pieces of ice held in the back of the mouth in contact with the bleeding surface; ice applied to the neck over the tonsil; powdered alum rubbed into the tissues; a strong solution of iron persulphate applied on cotton or with the finger; 2 drachms of gallic acid with 6 drachms of tannic acid to the ounce of water; pressure by forceps both externally and internally upon the tonsil, and firm compression of the common carotid artery. This compression reduces the supply of blood to the tonsil-stump and encourages faintness, and with fainting the hæmorrhage will probably cease.

"There is more bleeding in this young man's case than I have ever seen. It does not diminish. In fact, there is a constant stream of blood flowing into the basin. It looks as though we were to have our first experience with a persistent tonsillar hæmorrhage. I will send for ice, and exert firm, deep compression on the common carotid. The pallor of countenance and the beads of perspiration show the effect of the loss of blood. The profuse hæmorrhage is probably due to the fact that the recurring attacks of inflammation during the past years have left the gland in an indurated, fibrous condition, which prevents collapse of the blood-vessels. There is no history of a hæmorrhagic diathesis. We will deprive the vessels of their blood-supply until coagula form and plug their open mouths, and keep him in a sitting posture to assist in this and to promote faintness. We will not allow him to gargle fluids for fear of washing away any clots that may form, but give pellets of ice instead.

"It is now forty minutes since the tonsillotomy, and all hæmorrhage has ceased. The young man's room-mate will keep watch over him and inform us if there should be any return of the trouble, although I do not anticipate it if he remains perfectly quiet in bed the remainder of the day. He complains of feeling faint.

"This incident illustrates the necessity of always being prepared for emergencies. The most successful soldier, lawyer, or doctor is the one whom you can never surprise."

Suprarenal solution, applied on a firm compress to the bleeding surface, is effective, but in desperate cases the common carotid artery may have to be ligated.

The young man had no further hæmorrhage and made an excellent recovery. After these operations patients are given a spray of camphor-menthol in lavolin, 3 per cent., for use at home four or six times a day until all soreness ceases.

Edwin Pynchon has devised a method of removing chronically diseased tonsils when they are adherent to the faucial pillars and more or less buried, or "submerged." He has named this method "electro-cautery dissection." It consists in the use of a suitably bent electrode, of No. 21 irido-platinum wire, heated to a white glow while in the open air. Such a heat will give the least pain and the most rapid results. The tonsil is lifted toward the median line with a toothed, spring forceps while the electrode is entered at different marginal points and made to burn outward, gradually dissecting the tonsil away from its attachments. In this manner a part or all of one tonsil may be removed at a sitting. For adults he removes the upper half first, and the remainder in about two weeks.

In describing the operation he says:—

"By dividing the operation into two parts there is less soreness and less likelihood of secondary hæmorrhage. Under cocaine applied with a swab, using a 10- or 20-per-cent. solution in combination with 10 per cent. of phenol, a sufficient anæsthesia is often secured to render the operation painless. Hæmorrhage at the time of the operation is rare, and generally unimportant, though a certain amount of secondary hæmorrhage occasionally occurs within twelve hours after the operation, owing to a paralysis of the muscular coat of the blood-vessels due to the cocaine."

THE LINGUAL, OR FOURTH, TONSIL.

The lingual, or fourth, tonsil, is situated at the base of the tongue, in close relationship with the epiglottis. Histologically it closely resembles the other tonsils included in the lymphatic tissue, constituting the ring of Waldeyer, which "runs from the tonsilla pharyngea to the region of the Eustachian orifice, from there to the posterior rim of the velum palati, around the posterior palatal fold to the faucial tonsil, over the base of the tongue to the opposite side, and by a corresponding direction back to the pharyngeal tonsil" (Kayser).

The lingual tonsil is subject to the same pathological changes which occur in the faucial and pharyngeal tonsils, and, undoubtedly, many throat symptoms, such as globus hystericus, are attributable to this gland when the cause is not recognized. It may give rise to fugitive pains in the throat, cough, sense of fullness or of a foreign body, fatigue and impairment of the voice, and difficult swallowing and breathing. Occasionally there is some hæmorrhage due to the rupture of varicose veins in its vicinity.

Treatment.—The writer has obtained the most satisfactory results from electrocauterization of the gland, when it was diseased or so large as to cause distressing symptoms, using a large electrode at a white glow. Robert Levy's experience is the same (*Denver Medical Times*, October, 1900). J. Price-Brown cauterizes a number of the larger nodules at a time under cocaine anæsthesia, operating at intervals of several days. C. G. Coakley cauterizes from six to ten times at intervals of a week or ten days.

CHAPTER XVII.

DISEASES OF THE PHARYNX *(Continued).*

MYCOSIS OF THE PHARYNX.

Synonym.—Pharyngomycosis.

Pathology.—This is a very rare parasitic disease of the superior pharyngeal space, including the tonsils. Small, white or yellow growths appear, projecting above the mucous membrane, instead of occupying a recessive position, as is the case with tonsillar concretions. They may invade the lacunæ, but are not confined to them. They spread upon the soft palate, the pharyngeal membrane, and base of the tongue. As I have seen it, the growth is not soft like the cholesteatoma of the tonsil, but tough and somewhat difficult to remove in its entirety. It has, in some instances, a fungoid appearance, and penetrates the mucosa to such a depth as to prevent its removal with a probe.

Etiology.—The cause of this disease is obscure, but the microscope reveals the leptothrix buccalis, which finds a habitat in carious teeth.

Symptomatology.—No conspicuous symptoms are produced by this disease, but patients discover the growths accidentally and apply to have them removed.

Diagnosis. — The diagnosis is easily made, since the symptoms of inflammation characterizing pharyngitis, tonsillitis, etc., are wanting. It is distinguished from tonsillar concretions by the prominence of the growths and their location without the lacunæ.

Prognosis. — The tendency is not toward a spontaneous cure. The disease is very pertinacious and, like the regeneration of the drumhead, these growths often reproduce themselves as fast as they are removed.

Treatment.—If caries of the teeth is found it must receive attention. Delavan uses the curette and follows this with the galvano-cautery. After removing the fungi the membrane should be sprayed with undiluted hydrozone or mercuric bichloride, 1 to 10,000. Each growth should be treated as has already been recommended for enlarged pharyngeal follicles, using cocaine and then cauterizing half a dozen points at one sitting. In a monograph on pharyngomycosis leptothricia benigna, published in the *New Yorker medizinische Presse*, December, 1886, Max Toeplitz reviews the literature of the subject. Carbolic acid, sesquichloride of iron, and the sublimate solution, 1 to 2000, are recommended. Toeplitz uses the galvanocautery and curette. Homer M. Thomas also reports success from the galvanocautery.

CONCRETIONS IN THE TONSIL.

Pathology.—The tonsillar crypts are sometimes filled with an accumulation of dried secretions that consist principally of carbonate and phosphate of lime in the hard variety, and of a cholesteatomatous mass in the soft deposits. The latter consist of cholesterin, epithelial cells, pus-corpuscles, and micro-organisms. The hard concretions are called chalky or cretaceous concretions or calculi, and the soft ones cheesy or caseous deposits. These conditions are comparable to certain diseases of the ear that have been considered: cretaceous deposits in the drumhead and cholesteatoma of the tympanic and mastoid cavities.

Etiology.—Tonsillar deposits are due to an inflammation of the walls of the lacunæ.

Symptomatology. — The symptoms are not of a troublesome nature. A sensation of irritation or fullness, especially when swallowing, may be the only unusual thing to be noticed. The deposit can generally be seen as a cheese-like point, and several will likely be found by a careful examination. Sometimes they will be overlooked unless hunted for with a blunt-pointed probe to depress and bring forward the mouth of each opening. The difference in the consistence of the masses is readily detected by the sensation imparted through the probe. Patients often observe these concretions in their sputa, with which they have been expelled in the form of little, yellowish balls. Their presence is a menace to the health of the gland, for they degenerate into irritating excitants of inflammatory processes.

Treatment.—With the tongue depressed these concretions are removed without difficulty by the curette (Fig. 191). If they are reproduced the crypts should be treated to the hot electrode or some other cautery. H. W. Whitaker uses a 50-per-cent. solution of trichloracetic acid on a cotton-carrier for destroying the secreting surfaces of the tonsillar crypts (*The Laryngoscope*, November, 1897).

UVULITIS.

Inflammation of the uvula is sometimes more intense than the inflammatory action affecting the remainder of the pharynx. The swelling, œdema, and elongation of the uvula then constitute the conspicuous features of the disease. It increases to several times its normal proportions and hangs pendent upon the tongue, down toward the larynx. In this condition it gives rise to frequent swallowing and coughing (Plate III, No. 8).

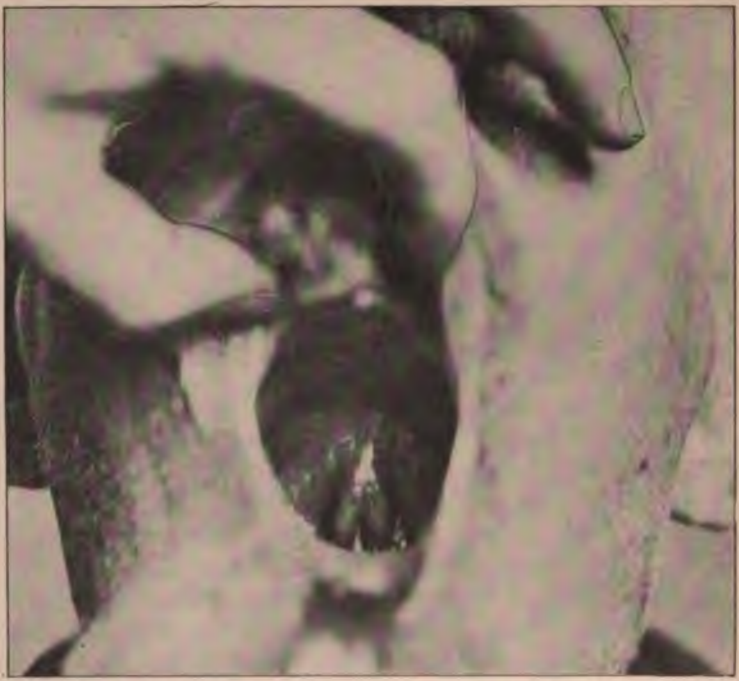


Fig. 79.—Bifid Uvula in a Man Sixty Years Old. (Author's Case.)

Treatment.—For the purpose of reducing the swollen, œdematous condition of the uvula a saturated solution of suprarenal extract is indicated. It should be plentifully applied repeatedly at intervals of three minutes until its effects are observed. Occasional reapplications may be necessary until the inflammation subsides. If the uvula is much elongated (Plate III) it should be clipped, with care that not enough be amputated to leave it too much abbreviated when swelling recedes and contraction takes place. I have known it to be completely removed by mistake, probably on account of the operator's poor sight, and the articulation of words was perceptibly defective. On the other hand, I have known syphilis to destroy it without producing this effect.

Bifid and Double Uvulas.

Considerable interest has been manifested of late in the subject of cleft uvulas, and a number of articles in the medical journals have given it much prominence. Some of the writers have maintained that these abnormalities are exceedingly rare, and that they call for prompt surgical interference to effect the removal of the supernumerary members.

These anomalies are certainly not common, but the examinations of a very large number of throats in Chicago have given the author the opportunity of seeing quite a large number of such cases. In nearly all instances the uvula is bifid somewhat as shown in Fig. 79, a photograph of a man 60 years old. We very rarely find two complete uvulas, as seen in the boy, 14 years old, in Fig. 80. More than 50 per cent. of the cases that have come under my observation show a division not to exceed one-half of the entire length of the uvula, and many of these show a bifurcation extending not more than one-third of its entire length. The upper portion of the uvula was often normal until about its lower one-fourth was reached. This branched out into two extremities with a mere notch of greater or less depth between them.

In some instances the two portions of the uvula were of unequal length, one being sufficiently elongated to lie upon the dorsum of the tongue. Speech was not perceptibly impaired, and no difficulty in deglutition was found. A. H. Ohmann-Dumesnil (*The Laryngoscope*, October, 1897) claims that "the entire absence of the uvula is of much more frequent occurrence than a double one." The author's experience is the reverse of this. Congenital absence of the uvula has been rarely seen by him, although its absence through pathological causes is not very infrequent.

The author has taken pains to question this class of patients relative to any inconveniences which they may have experienced from the conditions of their uvulas. With only a few exceptions they were entirely unconscious of the existence of any such anomaly. A few of the most intelligent and observing ones had discovered it and regarded the cleft as a mere curiosity.

Bifid and double uvulas are anomalous, rather than diseased, conditions. They are undoubtedly closely associated with those circumstances which cause cleft palate, and, as Trélat believes, they are, to an extent, hereditary. In Fig. 80 the process approaches very nearly to that which eventuates in cleft palate.

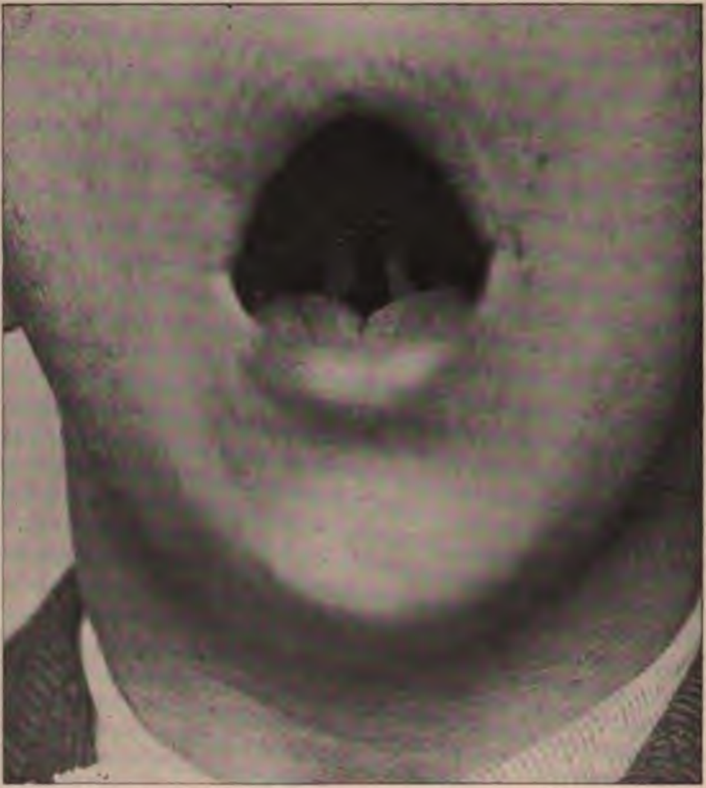


Fig. 80.—Complete Double Uvula in a Boy of Fourteen Years. (Author's Case.)

Treatment.—The author cannot agree with those writers who advocate trimming or amputating these supernumerary uvulas, in the absence of any definite indications for surgical procedures. The owners of these extra appendages were generally innocent of a suspicion that there was an unusual condition of their throats. If the elongated branch or branches tickle the tongue and cause coughing, the same reasons exist that we have in the same conditions of single uvulas for clipping the relaxed or elongated ends; but there is no occasion for the operation for cosmetic purposes. Here, as elsewhere, the knife should not be resorted to "without just cause or provocation."

TUBERCULOSIS OF THE PHARYNX.

Tubercular invasion of the throat is of infrequent occurrence.

Pathology.—A granular condition of the mucous membrane of the pharynx, showing areas of a gray color, precedes the breaking down of the epithelial layer that ushers in the stage of ulceration. The ulcers are superficial, of irregular forms, and ill defined. Like a granulating wound, they respond to the touch by bleeding.

Pharyngeal tuberculosis is generally secondary to miliary invasion of the lungs, and rarely develops in children. The granular neoplasm usually precedes the stage of ulceration. The writer has not met with the primary form, although he has seen the ulcerative form associated with laryngeal and pulmonary tuberculosis repeatedly. The nodules soon degenerate and break down into ragged ulcers, which may be surrounded by œdematous tissues. A yellowish secretion, sometimes thick, tenacious, and stringy, covers the eroded surface, and the frequent and distressing attempts to dislodge and expectorate this tenacious discharge are the cause of much suffering and exhaustion.

Etiology.—The throat invasion is generally secondary to the same affection of other organs.

Symptomatology.—The cough, constantly elevated temperature and accelerated pulse, loss of appetite and the characteristic expression of countenance, pallor of skin, and the habit of the body point toward the invasion of the great white plague. If the lungs are involved there will be expectoration, with cough; if not, the cough may be, at first, dry and hacking. The most conspicuous and distressing symptom is pain, especially during movements of the muscles concerned in deglutition and speech. The proper nourishment of the patient is interfered with by the difficulty and pain experienced in swallowing. He will refrain as long as possible from taking food, in order to escape the torture of eating. Inspection reveals the granular, or ragged, ulcerated condition of the mucous membrane already described.

Diagnosis.—Tubercular throat must be distinguished from syphilitic ulceration. The history of syphilis and the family history of tuberculosis must be sought. The latter disease is usually one of adult life, while syphilis, especially the congenital form, may occur in children. Syphilis is not attended by fever, and generally not by pain or very difficult swallowing. Its ulcers are clearly defined, with red areola and clean-cut borders possibly undermined. The ulcers of tuberculosis are shallow, ragged, and pale. They differ from scrofulous ulcers in that the latter are deep, with well-marked borders, and pain, fever, and cough are generally absent, while the muscles of phonation and deglutition cause little or no pain by their movements. The scrofulous affection occurs principally in children in whom there are no evidences of tuberculosis.

The following points in the differential diagnosis between tuberculous and syphilitic ulcers are given by Lennox Browne:—

TUBERCULOUS ULCERS.	SYPHILITIC ULCERS.
No apparent excavation.	Deeply excavated.
Much indolent granulation.	Few granulations, and those highly inflammatory.
Faint areola.	Deep-red areola.
Irregular and ill-defined edges.	Sharply cut edges.
Demarkation indistinct.	Demarkation distinct.
Grayish, ropy, mucous secretion.	Yellow, purulent secretion.
Discharge scanty.	Discharge copious.
Superficial, with lateral, instead of deep, extension.	Penetrating to deep tissues.
Fever.	No fever.

Prognosis.—This is an acute affection that proves quickly fatal from exhaustion. The average duration of the disease varies from six weeks to six months, but it may be prolonged much beyond the latter time.

Treatment.—For the relief of the most prominent symptom, pain, Sajous strongly recommends the application of a 10-per-cent. solution of cocaine, after cleansing the ulcers with a borax solution of 1 per cent. in the form of a spray ("Diseases of the Nose and Throat," 1892). He deprecates cauterization with silver as more hurtful than beneficial. Steam-inhalations of hot infusions of opium, belladonna, hyoscyamus, and conium produce a soothing, sedative effect and render swallowing less painful. A solution of creasote and menthol in lavolin, in the proportion of 2 per cent. of creasote to 10 per cent. of menthol, makes an excellent topical remedy. Iodoform insufflations have proven beneficial, but aristol is preferable. It is devoid of a disgusting odor and taste, is slightly anæsthetic, and adheres to the surfaces of the ulcers better than any other powder. Before applying any of these local remedies the discharges covering the ulcerated surfaces must be washed off by hydrozone or such an alkaline spray as Dobell's or Seiler's. A solution of sodium bicarbonate, 3 grains to the ounce, is also useful for this purpose. The cauterization of tuberculous ulcers by lactic acid, as practiced by Krause, is probably productive of more benefit than any other method. The ulcers are treated similarly to lupus. After cleansing and cocainizing them the acid is rubbed in by means of a cotton pledget, using a solution of 20- to 40-per-cent. strength, to begin with, and increasing the strength rapidly to 80 and 100 per cent. As fast as the eschars become detached, which they do in a few days, the treatments are repeated, until the process of cicatrization is seen to begin. If the tubercular granulations are covered with mucous membrane the latter must be incised to give the acid access to the lesions beneath. Heryng uses sharp curettes to scrape away projecting masses of tumefied tissues.

Cicatrization sometimes follows this method, but close watch must be kept for renewed breaking out of the disease in either the cicatrices or at new points.

J. Solis-Cohen condemns galvanocauterization as injurious "except under the most skillful manipulation."

Ingals makes use of either morphine troches or the following spray:—

℞ Morphiæ sulphatis, ... gr. iv.
Acidi tannici,
Acidi carbolici, ... of each, gr. xxx.
Glycerini,
Aquæ dest., ... of each, f℥ss.

Tuberculin and tuberculocidin have not fulfilled the expectations of the profession. The former has proven positively harmful, and since patients do as well under other forms of treatment as with the use of the latter, their employment is not recommended.

Creasote has been largely used internally and applied locally in recent years, and, while undoubted benefit has accrued from its use in the hands of eminent practitioners, there are some who discourage its employment. However, in a disease so intractable, and discouraging to both patient and physician as this must be admitted to be, whatever has proven beyond cavil and reasonable doubt to have been helpful in treatment is worthy of trial. Great caution is necessary in its administration to patients who have high temperature or hæmorrhages. It is given in doses of 1 to 10 minims or more three times a day, preferably in milk, as recommended by Glasgow. It can be given at any time with reference to meals, but is best taken before meals if well borne, since it then exercises a preservative influence upon ingested food against the process of decomposition. The effect of this upon the promotion of nutrition is apparent.

Creasote is readily taken in the form of capsules, or it may be combined with alcoholic or tonic preparations, as used by Cohen.

The feeding of this class of patients is an important subject. When the high temperature does not forbid much animal food, as much should be consumed as is consistent with good digestion. Milk, cream, codliver-oil, eggs, and vinous stimulants support the strength, improve nutrition, and prolong life. Added to these, the vegetable bitter tonics, iron, and quinine act as valuable aids to enrich the blood and increase the general tone of the body.

An out-door life in a high, dry, sunshiny, warm climate, with equable temperature, is conducive to the improvement of these patients, especially when combined with proper protection of the body by woolen underwear and a healthful employment of the mind and body in a cheerful or useful occupation. The most favorable climates are those of Southern California, Arizona, and New Mexico. Robert Levy says of Colorado: "I cannot add that our Colorado climate, so beneficial to pulmonary and, at times, to laryngeal phthisis, has any remedial influence upon pharyngeal tuberculosis. Miliary tuberculosis, with which tubercular ulceration of the pharynx is often associated, presents no encouragement in any climate, but in our high altitude it is my conviction that cases so afflicted decline very rapidly. The climate can only be of value in such cases as present no evidences of miliary tuberculosis or advanced disease, either local or constitutional." (*Denver Medical Times*, June, 1896.)

SYPHILIS OF THE PHARYNX.

Although the throat is subject to the manifestations of syphilis in the three stages of that disease, the primary lesion is not often observed in this locality. The history of chancre in the pharynx is similar to that of the same ulcer in other localities, with a duration of about six weeks. The secondary lesions are of frequent occurrence and the characteristic mucous patches are readily recognized. The tertiary stage is represented by the presence of gummata or eroding ulcers. The congenital form generally shows itself about five or six weeks after birth by the appearance of secondary lesions, and the tertiary stage at any time preceding the fifteenth or sixteenth year.

Pathology.—Chancres are generally found on one tonsil, while the secondary and tertiary lesions show a special predilection for the soft palate. The syphilitic eruptions of the throat are similar to those occurring in other parts of the economy and are often coincident with them. In the early stage papular elevations make their appearance, the epithelial covering of which becomes eroded; or erythematous patches occur in the form of a blush or mere hyperæmia of transitory duration; or the epithelium of these areas becomes exfoliated, leaving a denuded, pus-secreting mucous membrane beneath. These

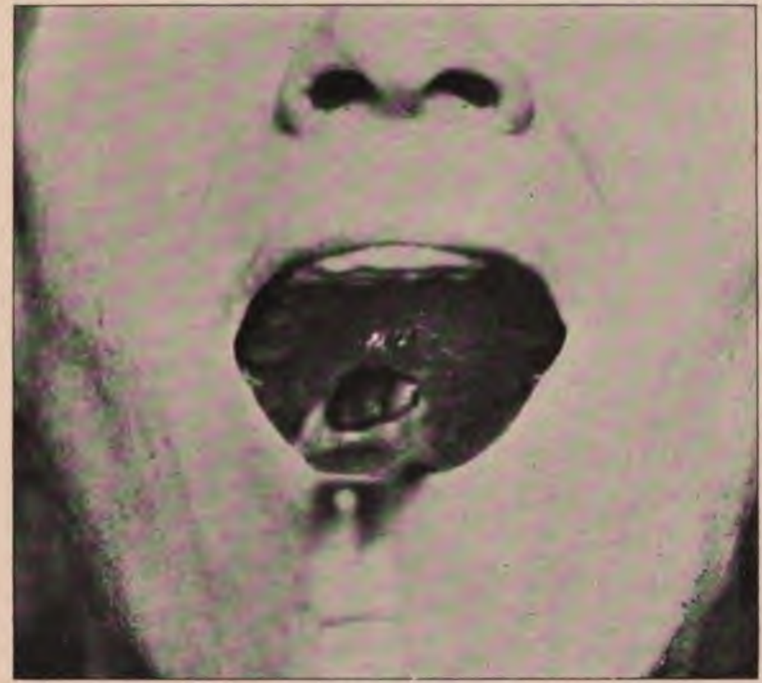


Fig. 81.—Large Perforation of the Velum Palati. (Author's Case.)
The lower border is covered with a light-colored discharge.
Perforation closed entirely in three months.

mucous patches now assume an ashy-gray color, with a rough, granular surface. They are eruptions of the secondary period of syphilis and extend their boundaries so as to invade a large territory in a comparatively brief period. They are surrounded by a red areola and a well-defined border, and there is a copious, purulent, nasty discharge from them.

In the tertiary stage the ulcers are deeper than the mucous patches of the secondary period. The infiltration extends to the whole depth of the membrane and results in irregular thickening and induration in the form of nodules or gummata. If these are incised in the early stage they exude a glairy fluid. In time they degenerate into a caseous mass, which becomes surrounded by dense connective tissue. They are closely analogous to tubercle, but differ from the latter in their greater tendency to the formation of connective tissue. The increased proliferation of connective tissue produces pressure on the blood-vessels that supply the gummata with nutrition, thus cutting off their own nutrient sources. Breaking down and softening follow in each gumma, presenting a yellow spot which is soon the seat of an ulcer.

The mucous patches of the secondary stage are superficial and may end in resolution with contraction of the tissues as the cicatrix forms. The tertiary ulcers may occur in any part of the pharynx. They extend rapidly and deeply, perforating the pillars of the fauces or the velum (Fig. 81) in a few days, and gradually eating away the whole velum, uvula, and faucial columns, as illustrated by one of my cases in Fig. 82.

Etiology.—The specific virus of syphilis is yet one of the unknown quantities in medicine, notwithstanding the fact that a considerable percentage of humanity are, or have been for many generations, infected by it. The occurrence of the primary lesion in the mouth or pharynx is generally in consequence of kissing or of using utensils not thoroughly cleansed after having been used by syphilitics. They may also result from certain practices of sexual perverts. The secondary stage of syphilis is quite generally accompanied by throat lesions, and next to the genitals the throat is the most frequently affected. Tertiary manifestations may crop out in the pharynx a quarter of a century after the appearance of the initial sore, but the average interval is about seven years ("the perfect number"?).

Symptomatology. — The primary lesions of the throat are attended with so slight a disturbance that they are altogether likely to be overlooked. The submaxillary lymphatic glands may be enlarged and tender to the touch. Inspection discloses a red, or perhaps a gray, denuded spot with prominent edges. It generally disappears spontaneously. As already remarked, the initial lesions are found principally on the tonsil.

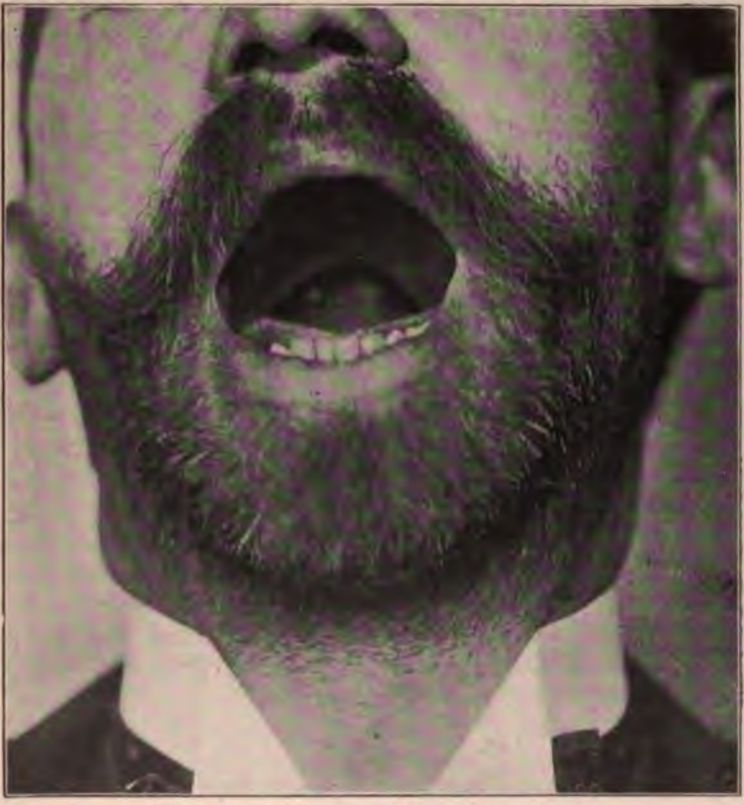


Fig. 82.—Destruction of the Velum Palati.

Fournier "recognized syphilitic ulcer of the tonsil in 40 per cent. of his cases of ulcers of the mouth. The sore is generally single, and sometimes covers the whole tonsil, occasionally extending to the pillars of the fauces and to the base of the tongue. The erosive form is the most common. The symptoms are trifling, but the ulcerative form causes pain and difficult swallowing; the ulcers are brown, gray, or yellow and the tonsil is indurated." Occasionally there is some systemic disturbance.

Secondary symptoms manifest themselves as an erythema or as mucous patches on one or both sides of the throat. The erythematous eruption occurs either in blotches, suggestive of the roseola, or it may appear as a diffused redness spreading over the whole pharynx. This stage is attended with the usual symptoms of simple sore throat. After a few days distinct patches are clearly made out on the anterior columns or on the velum and other parts of the throat or mouth. The sides of the tongue near its base are especially liable to suffer. At first these mucous patches appear as slight, rounded elevations of a dark-red color. Their centres soften and break down, leaving a characteristic, slightly cup-shaped excavation, which later assumes a gray color. In this stage swallowing is attended with pain.

The tertiary lesions generally begin by attacking one tonsil and the adjacent faucial pillars. The nodular and gummatous points begin to show signs of breaking down, then the epithelial layer covering them grows thin, revealing a yellow spot underneath. Finally the epithelium is exfoliated, exposing an ulcerating process which penetrates the mucosa deeply, leaving an accentuated cup-shaped depression surrounded by uneven, but prominent, ragged edges. These ulcers are rapidly destructive to the soft tissues, and do not seem to be retarded in their erosive action by cartilage or bone. I have seen them perforate the soft palate in a few days, and for a time no treatment would stay their progress or appear to produce any impression whatever. The whole soft palate is sometimes destroyed, as I have seen in a series of cases (Fig. 82). Cicatricial contractions have the effect of narrowing the lumen of the throat, and adhesions may encroach seriously upon the upper part of the pharynx or even shut it off from the lower part by adhesions of the soft palate to the posterior pharyngeal wall, similarly to the condition shown in Fig. 84.

It is somewhat remarkable to observe the trivial character of the subjective symptoms as compared with the extensive gnawing away of the structures of the throat. I have seen this corrosive process plowing through the faucial columns and the velum, leaving perforations, eating away their borders until several small apertures united into one large hole, destroying one of the supporting shreds of the velum, and allowing the ragged remnant to drop and hang as a pendant, swaying and fluttering with the currents of the air. Patients subject to these erosions sometimes appear to experience less inconvenience from them than others suffer from a common cold. But in some individuals much pain attends the process, and swallowing causes a distressing effort. Solids must be eschewed and the diet confined to liquids until amelioration of the condition can be brought about.

Diagnosis.—This disease may be mistaken for tuberculosis, and in the early stage may be confounded with a simple catarrhal inflammation of the mucous membrane. But the latter yields readily to treatment, while the syphilitic disease progresses uninfluenced by any other than specific treatment.

In tuberculosis serious constitutional disturbances are present, such as are not accompaniments of syphilis: fever, emaciation, etc. The areas of hyperæmia that later become the seat of ulceration are paler and softer in tuberculosis than in syphilis. The ulcers of syphilis have more regular, clearly defined borders and are deeper than in tuberculosis. The pain of the latter disease, especially in swallowing, causes great suffering, while it may not be a prominent symptom of syphilis and may be absent altogether. The patient improves and gains in weight on specific treatment in syphilis, but grows worse in tuberculosis. The presence of pulmonary tubercular lesions will aid in clearing up the diagnosis.

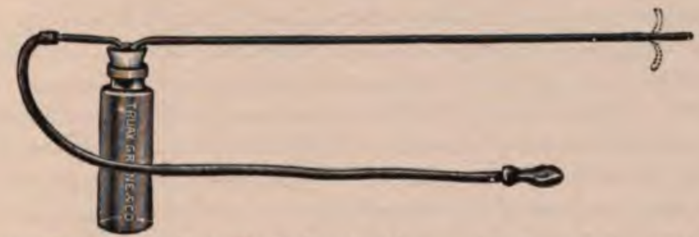


Fig. 83.—The Author's Small Powder-blower with Long Tube. It can be operated by a small rubber bulb, also.

Prognosis. — The primary sore disappears in about six weeks. The secondary lesion is about that time in coming on after infection and lasts approximately the same length of time when left to nature. The third stage is far more serious, for, while the primary and secondary periods may not menace health or life, the tertiary form invades all tissues with a wanton destruction that is sometimes appalling. Important structures are not immune. A large blood-vessel may be opened and cause a fatal hæmorrhage. Contractions of cicatricial tissues may constrict the throat and seriously interfere with breathing, swallowing, and speaking.

Treatment.—Cleansing solutions should be used on the ulcerating surfaces before local applications will be of any avail. For this purpose I have had satisfactory results from hydrozone and the alkaline antiseptic solutions of Dobell and Seiler, in the form of a coarse spray with sufficient force to the stream to dislodge and wash away all the dirty secretions. These are good, cleansing, soothing sprays for the primary lesions and the erythema also. Then we touch the denuded surface with tincture of iodine, pure, by means of a small cotton pledget twisted hard upon the silver applicator. When the iodized cotton is pressed upon the ulcerating part, not enough of the tincture should be left to run down over the healthy membrane. This treatment is usually followed by a drying up of the discharges and the institution of a healthy granulating process.

If the throat is exceedingly painful, especially upon swallowing, one is justified in painting it with a 4-per-cent. solution of cocaine just before meals, to insure sufficient ingestion of food to support the strength. After cleansing and drying the ulcers with absorbent cotton, we cover them with a coating of aristol or nosophen by means of a small powder-blower (Fig. 83). The antiseptic and slightly anæsthetic effects of aristol, besides its power of promoting granulation formation, have seemed to me to transcend the properties of any other single remedy. Sajous cleanses with a solution of potassium permanganate, and uses zinc sulphate or lead acetate, in a 5-grain solution, for their astringent effect, or 5 minims of the tincture of the chloride of iron in a drachm of glycerin. Mackenzie used 20 grains of the zinc chloride to the ounce for the erythema, and tincture of iodine for the mucous patches. If the ulcers were indolent he preferred copper sulphate, 15 grains to the ounce. In the secondary and tertiary periods I employ mercury and potassium iodide, the mixed treatment, and tonics, with whatever general treatment the condition of each patient suggests.

CHAPTER XVIII.

DISEASES OF THE PHARYNX *(Continued).*

ANOMALIES AND NEW GROWTHS.

ANOMALIES of the pharynx are most conveniently treated of under two headings: (1) malformations and deformities and (2) new growths.

MALFORMATIONS AND DEFORMITIES.

Malformations of the pharynx are of two varieties: stenoses and dilatations. Stenoses either exist from birth or they may be acquired, in which cases they are called congenital, on the one hand, or post-natal, on the other, and they may be either complete or incomplete. The congenital form is due to some intra-uterine anomaly of development. While the stenosis may be located in the upper part of the pharynx, where the nasal and oral portions meet, it is more frequently met with in the lower division, opposite the cricoid cartilage of the larynx. Then, at this point is found a diaphragm of mucous membrane, which constricts the passageway to one-half or less of its normal lumen, and complete atresia has been known.

The high stenosis, which occurs in the palatal region, is caused by a membranous expansion extending backward and laterally from the soft palate to the back wall and sides of the pharynx.

The acquired, or post-natal, malformations are due to two kinds of causes: intrinsic and extrinsic. As examples of the former, which originate within the pharynx, the following may be mentioned: Diphtheria, scarlet fever, small-pox, erysipelas, lupus, syphilis, and traumatisms. Examples of the latter, or causes originating and operating without the pharynx, are tumors, abscesses, and deformities of the spine.

Intrinsic stenoses are quite likely to be attributable to syphilis, when the appearance of scar-tissue in the diaphragm and in the neighboring soft parts, and particularly the presence of a perforation of the hard palate, will clear up the diagnosis. Scarlet fever is occasionally responsible for a pharyngeal stenosis.

These constrictions of the pharynx may not give rise to actual pain, or even serious inconvenience, unless they become the seat of an inflammation, which is not a common occurrence. In one of my cases, shown in Fig. 84, a young lady's throat is divided into superior

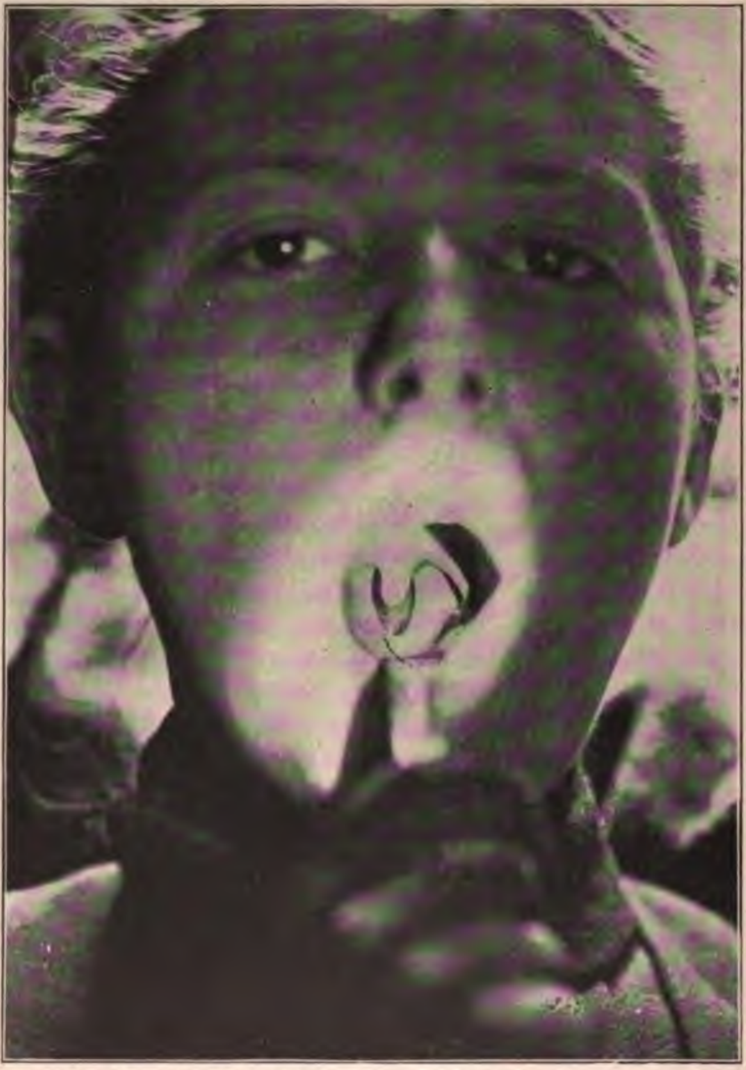


Fig. 84.—Stenosis of the Pharynx. (The Author's Case.) The resulting diaphragm is perforated behind the uvula.

and inferior portions by an adventitious membrane extending between the posterior columns and arch of the palate, on the one hand, and the lateral and posterior pharyngeal walls, on the other. An oval aperture is seen behind the uvula, through which nasal respiration takes place. The only inconvenience suffered is the lodgment of particles of food behind the new membrane. This aponeurosis, or pharyngeal diaphragm, is the result of the throat affection attending scarlatina, which she had when she was a small child.

Among the traumatic causes of stenosis of the pharynx we may mention scalding liquids and chemical caustics, such as carbolic acid, lye, etc.

Treatment.—If the adhesions are of a syphilitic character, general treatment should be instituted, combining the mercurials and potassium iodide. The local treatment, which has principally prevailed, consisted in the employment of graduated bougies for the purpose of dilating the strictures; but this method promises indifferent results, since the fibrous tissues are prone to contract again after the dilatations cease.

The electric cautery presents a more effective remedy. The membrane should first be treated to a strong solution of the suprarenal gland. Then an 8-per-cent. solution of cocaine is repeatedly applied, not by means of a spray, but by cotton firmly twisted on a holder. This is carried to all parts of the periphery of the diaphragm. The object of reversing the customary order of applying these remedies is as follows: We contract the blood-vessels and minimize the amount of cocaine that may be absorbed and which might produce toxic effects. When the tissues are previously contracted, the cocaine penetrates them relatively more deeply, and for that reason renders the operation the less painful. The writer always employs the remedies in this order, and has found it possible by this method to use the stronger solutions without toxic effects. No more cocaine should be applied than will moisten the area to be operated upon. So extensive an absorbing surface must be treated to cocaine in throat surgery that one should be on his guard to avoid the use of too great an amount of the drug. Most deplorable accidents have been brought to the writer's knowledge, but these were undoubtedly due to the use of too strong preparations or to spraying the parts. Instead of employing 20- or 33-per-cent. solutions, it is wiser to confine one's self to the 4- or 8-per-cent. preparation for the sake of safety.

The operation consists of entering the periphery of the membrane with an electrode and passing this around the circumference until the adventitious tissue is completely detached. The electrode should be hot enough to show a white glow when not in contact with the tissues. As it burns its way through, the heat closes the mouths of the blood-vessels—sears them over—so as to prevent hæmorrhage, providing that the electrode is removed from contact with the tissues while it is still hot. After the operation the patient should be kept under observation a sufficient length of time to satisfy the surgeon that there is no danger from hæmorrhage. Should any occur, the suprarenal solution must be used to stop it, after which a cotton pledget saturated with a 10-per-cent. solution of silver nitrate should be pressed firmly against the bleeding surface, or the solid pencil of the same may be employed. If the stenosis has been occasioned by lupus, the x-ray treatment should be employed.

Extrinsic stenosis of the pharynx is due to such causes as tumors and abscesses. For example, there may be a goitre, an aneurism, a deformity of the spinal column, or a retropharyngeal abscess.

Dilatation.

When the pharynx becomes dilated, the whole or only a part of the tube may be affected. This condition usually presents a pouch, or sac, which becomes more and more distended with advancing years. The congenital form is due to a prenatal anomaly of development.

The post-natal dilatation, or diverticulum, results from a defective or weakened state of the muscular walls of the pharynx, which readily yield to pressure exerted by large boluses of hastily swallowed food. The unhealthful habit of bolting imperfectly masticated food is a cause only secondary to an inherent weakness of the pharyngeal tunic. When a weakened area once yields to pressure the dilatation may continue, very much as an aneurism of an artery gradually distends, until the pouch becomes several inches long. It generally projects downward and posteriorly to the œsophagus, lying alongside the cervical spine. It is usually covered by the submucous and mucous pharyngeal tissues, but it may also be enveloped in the cellular membrane of the œsophagus. Sometimes a tumor is found in the side of the neck, formed by a deflection of a pharyngeal pouch toward that side.

The most constant symptom of this anomaly is caused by the obstruction which it offers to the act of swallowing. Food lodges and accumulates in the sac until its distension interferes with deglutition. But the afflicted one usually learns to manipulate the pouch and press out its contents. Otherwise the contained food is liable to undergo decomposition and set up an inflammatory process, with disastrous consequences. However, it has happened that such an inflammation eventuated in the formation of adhesions between the opposing walls of the sac, with the result of closing it and curing the anomaly; but the danger lies in a probable sloughing of the adjacent structures. Distressing symptoms may be occasioned by the ejection of the imprisoned food from the sac into the larynx. Suffocative attacks, spasmodic coughing, bronchitis, and even pneumonia may supervene.

Diagnosis.—The diagnosis is rendered a simple task if, in addition to bearing in mind the symptoms already detailed, we observe that the tumor can be dissipated by pressing out its contents of undigested food, that it recurs again on the ingestion of food, that the ejection of undigested matters is not coincident with an act of vomiting, and that particles gain entrance to the larynx at other times than during a meal. In addition to these points the use of the throat-mirror and a digital exploration will afford corroborative evidence.

Prognosis.—The prognosis is not favorable in the absence of corrective operative interference. There is an abiding danger of putrefactive changes in the retained food, and resulting inflammation, suppuration, and sloughing. To obviate such consequences, it may be necessary to restrict the patient's diet to fluids. In favorable cases the anomalies may be obliterated by operative intervention.

Treatment.—Before passing to the subject of operative treatment we will consider what the patient may do to promote his comfort and safety. While partaking of food he should exert pressure over the pouch in such a manner as to prevent food from entering it, or he can wear a compress over it to accomplish the same purpose. Whenever food enters the sac he should manipulate it until it is evacuated, and he may even wash it out with a properly constructed syringe, so as to prevent the fermentation and putrefaction of food.

Operative treatment consists first in applying the electric cautery to the periphery of the mouth of the diverticulum so that adhesions between these freshened opposing surfaces will result in their permanent union and a consequent obliteration of the entrance to the cavity. This is done after the exhibition of the suprarenal solution and cocaine, as we have previously described in the treatment of stenoses of the pharynx. After this operation rectal alimentation should be resorted to until the adhesions are sufficiently firm. Certain cases may not lend themselves to this kind of an operation, when such measures as are employed in pharyngotomy and œsophagotomy may need to be brought into requisition, after which the edges of the divided membrane should be sutured in order to perfect the closure of the tube.

NEW GROWTHS OF THE PHARYNX.

The following classification will be adhered to in treating of pharyngeal neoplasms:—

1. **Epiblastic and hypoblastic**
   - **Papilloma.**
   - **Cystoma.**
   - **Carcinoma.**
2. **Mesoblastic**
   - **Fibroma.**
   - **Lipoma.**
   - **Angioma.**
   - **Sarcoma.**

PAPILLOMA.

Papilloma is an epithelial tumor having a benign character, and is made up of epithelial cells and a framework of connective tissue beneath the epithelial proliferation. The vascular area is within this tissue and separated from it by the membrana propria. This form of tumor is liable to degenerate into a malignant one, especially so when it is situated, as it is in this case, in a passageway which subjects it to frequently repeated irritation. For this reason it becomes the seat of recurring attacks of inflammation, and further predisposes the patient to an extension of this inflammation to adjacent structures: to the larynx and even to the lungs. Papillomata are frequently found on the velum palati, the uvula, the faucial pillars, the tonsils, and on the posterior wall of the pharynx, and they vary in size from a hemp-seed to an ordinary cherry.

Symptomatology.—The symptoms produced by papillomata, before they become subject to an inflammation or to degenerative changes into malignant tumors, may be of no moment. Indeed, many patients are ignorant of the existence of these neoplasms in their throats until informed of their presence by their physicians.

Diagnosis.—The diagnosis is attended with little or no difficulty, especially when they are not inflamed. They resemble small warts, and may have a cauliflower appearance. They are either red, pale-pink, or of a gray color, and their surfaces, moistened with secretions, reflect the light from their convex peripheries. If any doubt exist as to their nature, a section should be taken in each case from the base of the growth for a microscopical examination.

Prognosis.—The prognosis in most cases may be said to be favorable. We have encountered many instances in which no appreciable symptoms were referable to these growths. On the other hand, there is the ever-present liability of their undergoing a transformation into carcinomata or sarcomata.

Treatment.—For the sake of reducing to a minimum the likelihood of inflammatory attacks and a degeneration of the tumors, papillomata had best be extirpated and the seats of attachment should be well cauterized. The growths may be severed and their seats of attachment cauterized at the same time by the employment of the electric snare or knife. Or the tumor may be cut off with the scissors, cold snare, or a knife, and the attachment treated by a chemical caustic, such as silver nitrate.

CYSTOMA.

In cystoma the wall of the cyst is produced from a matrix of embryonic cells, and the products of tissue-proliferation of the cells lining the cyst-wall constitute the contents of the sac. These are not frequently met with in the pharynx, but retention cysts are formed in consequence of inflammatory processes in the ducts leading from glands. The resulting stenoses of these ducts obstruct the progress of the secretions from the glands outward. Hence, an accumulation of the secretion takes place, distending the ducts more and more behind the constrictions until the swellings appear. The pressure of the contents of the sacs on their epithelial lining causes atrophy of the latter, which becomes greatly attenuated. These cysts are generally found in adults and those who are past middle age.

Treatment.—The cysts should be opened and evacuated, and their walls should be destroyed. The electric cautery, or the knife and the curette, may be employed. After the latter, the pencil of silver nitrate should be used.

CARCINOMA OF THE PHARYNX.

Pathology.—Cancer of the superior portion of the pharynx is generally of the scirrhous form, and presents, in its early history, an indurated mass not clearly defined in its circumference. At first the mucous membrane covering it may not show any visible changes. The growth may extend to include the soft palate and pharyngeal vault. As the epithelium breaks down and ulceration of the surface of the tumor begins, a fetid exudate bathes the surface, which assumes a red or light-greenish appearance. Large, pedunculated granulations are sometimes to be seen, during this carious process, springing from the floor of the ulcer. The submaxillary lymphatic glands become infiltrated early in the attack.

When the cancer is situated in the lower part of the pharynx, or the pharyngo-laryngeal cavity, it generally takes on the character of epithelioma. Its most usual site is a little below the arytenoid cartilage. Instead of the red or light-greenish surface of ulcerating scirrhus, this variety presents a gray surface inclosed by the very red, tumefied, mucous membrane. The disease spreads until it circumscribes the passage.

Etiology.—"Recent researches have been made with a view of demonstrating the microbic origin of the primary and secondary tumors, but so far no conclusive proof has been furnished of the microbic origin of carcinoma. Our present knowledge concerning the origin and growth of carcinoma warrants us in making the statement that carcinoma is the result of an atypical proliferation of epithelial cells from a matrix of embryonic cells of congenital or post-natal origin, and the local and general infections are caused by the local and general dissemination of carcinoma-cells." (N. Senn.)

Symptomatology.—Inspection reveals the presence of a tumor or an ulcerating surface. The symptoms are characteristic of a lesion obstructive to respiration and deglutition. Phonation is interfered with, the speech is thick, and there is a foul-smelling, frothy expectoration. Swallowing is painful, but the suffering is not limited to this act, being constant and sometimes extending to the Eustachian tubes and ears.

Diagnosis.—This is not obscure. It is possible to mistake this for a syphilitic lesion, but the use of mercury and potassium iodide will remove all doubt. In a case recently under my observation the attending physician was not able to reach a conclusion. I suggested that a mixed treatment would soon result in recovery, which in a few weeks followed, demonstrating the specific nature of the lesion.

Prognosis.—Sooner or later death closes the scene.

Treatment.—Hitherto, palliative measures have formed the chief reliance of the physician. If death is impending by obstruction to respiration, intubation or tracheotomy may prolong life. Nourishment may be administered by the œsophageal tube or by enemata, when swallowing is obstructed. Cocaine, morphine, and sedative sprays afford temporary relief only.

Thomas Hubbard reports a case of squamous epithelioma of the velum palati cured by injections of caustic potash by a curved platinum needle. Injections were repeated wherever proliferating epithelial growths were seen. Cicatrization was rapid as well as the general improvement. The case remained cured after two years.

Karl Schwalbe, O. Hasse, and others have advocated injections of alcohol into cancerous growths as a curative measure, and instances have been reported in which complete cures have been claimed as the result of these interstitial injections. As having a direct bearing on this subject, we will refer to the following observations of Hasse, which cover a broad field: "Alcohol favors cicatrization in all growths like struma, angioma, cysts, lymphatic-gland tumors, sarcoma, carcinoma, and especially carcinoma of the breast and cervix uteri. Under its use, in fifteen out of eighteen cases of carcinoma of the breast, the growth gradually dwindled away until in a year there was nothing left but the connective-tissue stroma, and there has been no return. Five cases of carcinoma of the cervix also recovered completely, and the patients are still living and in good health. The effect on the general health is even more surprising. The pains and uneasiness pass away, and sleep, appetite, assimilation, and strength return in a most remarkable manner." This method of treatment has been applied to cancer of the naso-pharynx with promising results, and should be given extensive trials to definitely determine its limitations of usefulness in this field.

Schwalbe and Hasse reasoned that if alcohol would produce contraction and atrophy of tissues, as occur in the cirrhotic liver of the inebriate, it would have a similar effect on a neoplasm into the parenchyma of which it might be injected. While the former believes that its curative effect is produced, when injected into the interior of the tumor, by causing the formation of new connective tissue, with the obliteration of blood-vessels, lymphatics, and the parenchyma, Hasse practices injection into the circumference, maintaining that the new connective-tissue formation, girdling the periphery of the growth, would choke the afferent and efferent blood-vessels and thus cause atrophy.

Hasse employs a Windler syringe, but others prefer a Pravaz.

The alcohol is used in the strength of from 30 to 50 per cent. At first but a small quantity may be endured, for the injections are very painful, but the quantity may be increased gradually from 6 to 30 or 40 minims.

The object of the interstitial injections is to surround the tumor with alcohol so as to cause contraction of the connective tissue, fatty degeneration of the cancer-cells, and obliteration of the blood-vessels.

FIBROMA.

See "Fibrous Tumors of the Naso-pharynx," page 131.

LIPOMA.

A lipoma may be either a circumscribed or a diffuse tumor, and consists of fatty tissue produced from a matrix of lipoblasts. It is not often found in the pharynx, but, when present, it gives rise to the well-known symptoms of a foreign body in the throat. It is likely to be mistaken for an abscess when it has a soft consistency, but the absence of symptoms pointing toward pus-formation, and an exploratory puncture or incision, will clear up the doubt.

Treatment.—When the tumor is pedunculated it may be removed by the electric snare or knife or the cold-wire snare, but, if it is of the diffuse type, resort should be had to electrolysis.

ANGIOMA.

Virchow included in this class all vascular tumors, but the restricted definition of the present day limits the application of this term to a growth consisting of new blood-vessels which communicate with the surrounding vessels, of interstitial tissue the same as that from which the tumor springs, and of the blood within the vascular spaces. On the other hand, growths that are composed of lymphatic vessels are designated as lymphangiomata.

Cruveilhier's submucous venous plexus, which is an oval group of veins in the back portion of the pharynx, may become so engorged and tumefied as to produce symptoms comparable to those which are occasioned by a foreign body in the pharynx and an irritating cough. The surface presents a purple, dense, and lobulated appearance. It is not uncommon to find groups of varicose veins in the pharynx that resemble clusters of currants, or blackberries, which bleed on being irritated. These tumefactions may give rise to much discomfort and anxiety, and they interfere with the articulation of speech, and with swallowing, when they reach considerable proportions. They also provoke efforts to swallow, and may even embarrass respiration and cause serious hæmorrhages.

Treatment.—When angiomata give rise to the distressing symptoms mentioned, they should be extirpated; but, as they are generally sessile, or diffuse, instead of pedunculated, electrolysis is best adapted for their eradication. If the tumor is of considerable proportions and profuse hæmorrhage is imminent, it may be necessary to perform thyrotomy after a preliminary tracheotomy.

SARCOMA.

This is an atypical proliferation of connective-tissue cells from a matrix of fibroblasts of congenital or post-natal origin. It springs from the submucous connective tissue, and generally depends from the inferior surface of the body of the sphenoid bone into the pharynx. Owing to the rich supply of lymphatic structure in this locality and its invasion by the sarcomatous cells, the tumor may show a transition into the variety which is known as lymphosarcoma. Fortunately, this growth is not frequently met with in the pharynx.

Symptomatology.—The symptoms produced by a pharyngeal sarcoma relate to impairment of the voice and embarrassment of swallowing and breathing. There is an increase in the secretions of the naso-pharynx, and, after ulceration occurs, the discharge is tenacious, bloody, and foul; but serious hæmorrhages are not necessarily a part of the history of sarcoma. When there is pain, it is proportioned to the degree of pressure on the surrounding parts.

Diagnosis.—The diagnosis should be rendered certain by a resort to microscopical examinations of sections from the tumor.

Prognosis.—The prognosis is an unhappy one; the progress is toward a fatal termination.

Treatment.—If the growth can be enucleated from a circumscribing pseudocapsule, leaving no remnant of diseased tissue, and no metastasis has occurred to render nugatory the result of the operation, it should be done. It is useless to operate if a part of the growth be left, for a rapid reproduction will occur; and, if metastatic tumors have formed in other parts, nothing will avail from operative procedures. Then there is little to be done save rendering the conditions as tolerable as possible by the employment of detergent, disinfecting, and astringent applications.

CHAPTER XIX.

DISEASES OF THE PHARYNX *(Concluded).*

RETROPHARYNGEAL ABSCESS.

Etiology.—Abscess in the posterior pharyngeal wall may result from acute inflammation of the pharynx or of the submucous tissue and glands; from a middle-ear suppuration, in consequence of the pus breaking through the anterior wall of the tympanic cavity or through the semicanal for the tensor tympani muscle, and from a disease of the vertebræ. It is more likely to occur in the strumous or syphilitic, and may be a sequel of the eruptive fevers or diphtheria. Traumatism resulting from the swallowing of fish-bones, the impact of a lead-pencil, etc., or scalding liquids and destructive chemicals may give rise to retropharyngeal abscess.

Symptomatology.—If the abscess is located in the upper and back part of the pharynx there is a sensation of fullness accompanied by obstruction to nasal respiration with nasal voice. The tumor may be seen in this locality with the rhinoscopic mirror, and if it is not too high it may become visible by using the palate-elevator (Plate IV). On passing the finger into the vault of the pharynx it meets with a resistance which may be mistaken for adenoid vegetations. When it is posterior to the base of the tongue it can be brought into view by the use of the tongue-depressor. If the swelling is behind the glottis and attains a large size it is liable to press on the epiglottis and embarrass its functions. The swallowing of foods and liquids is so interfered with as to cause their entrance into the larynx. Dyspnœa of such a serious degree as to endanger the patient's life may result from an abscess in this region. Occasionally the tumefaction increases to such a size as to be visible by means of a swelling in the side of the neck. The inflammatory process may extend to the cervical glands, producing induration, pain, and tenderness.

The head generally assumes a position suggestive of torticollis, being held fixedly to one side with the face upturned and everted.

The general condition is one indicative of a severe illness. The temperature is often somewhat elevated, and thirst adds to the general discomfort. Like tonsillar abscess, rupture takes place usually into the throat. The evacuation of pus may fill the larynx and cause strangulation, or, if relief is not obtained early enough by incision or rupture, a dangerous or fatal œdema of the larynx may occur, or the pus may burrow among the cervical muscles and produce an abscess of the neck, or it gravitates to the thoracic cavity.

Inspection shows a bulging of the mucous membrane at the seat of the swelling. The tumefaction and the contiguous structures present a dark, dusky-red hue, including the uvula and soft palate. Fluctuation can be felt by pressure with the finger over the bulging surface.

Diagnosis.—Retropharyngeal abscess may be confounded with other inflammatory affections of the throat, but the absence of cough, pseudomembrane, vocal changes, and ulcerative conditions of the mucous membrane, taken together with the presence of obstruction to respiration and deglutition, the unnatural fixation of the cervical muscles and twisting of the neck, the presence of bulging and fluctuation in the walls of the pharynx proper are decisive diagnostic features.

Treatment.—If seen early, ice (Fig. 194) should be applied to discourage pus formation. As soon as fluctuation can be made out the abscess should be punctured with bistoury or trochar, making an opening sufficient to evacuate the cavity, but not large enough to cause a profuse gush of the contents so as to overwhelm the patient by filling the larynx and causing strangulation. MacCoy recommends that the incision be made high enough in the swelling to necessitate pressure on the tumor to empty it, so as to avoid too great and continual flow of pus. The incision should be made in a nearly vertical direction, leaving a small wound, so as not to favor the entrance of food into it during the act of swallowing. The internal carotid artery must be avoided by cutting toward the median line. Cocaine or eucaine should be painted, in a 4-per-cent. solution, over the part to be entered, before the operation. A trochar can be used instead of the knife, but care is necessary to prevent it from plunging beyond the abscess, as the wall yields, and injuring the parts beneath. The vertebræ are easily damaged by such an accident. The instant the abscess is opened the patient's head should be thrown forward to prevent the flowing of pus and blood into the larynx. The part of the knife-blade that is not to enter the tissues is protected by twisting cotton firmly around it as is done on the cotton-carriers.

The blood is likely to be found impoverished, demanding iron and a nutritious diet. Alteratives containing iodine and the bitter tonics are useful. The throat should receive proper attention until the wound heals, and any abnormality present should be corrected.

NEUROSES OF THE PHARYNX.

There are two varieties of neuroses affecting the pharynx,—one of sensation, the other of motion.

NEUROSES OF SENSATION.

These affections are of four kinds: hyperæsthesia, anæsthesia, paræsthesia, and neuralgia.

HYPERÆSTHESIA.

The upper portion of the pharynx is liable to increased sensitiveness in persons subject to frequently recurring attacks of inflammation, and in the hysterical. No other abnormality may be discernible in the individual aside from the exquisitely sensitive throat.

Treatment.—If any inflammatory condition appear on examination, this must be combated by such remedies as have been mentioned for pharyngitis, etc. If the condition give considerable discomfort one may be justified in applying cocaine or eucaine in a 4-per-cent. solution, without the patient's knowledge of the nature of the remedy. A 10-per-cent. solution of carbolic acid in glycerin obtunds the sensibilities of the nerve-ends, and does not present any of the objections applicable to cocaine. The membrane can be protected by an emollient and slightly anæsthetic spray consisting of camphor-menthol in lavolin. It is best to begin with a 3-per-cent. solution of this, giving the patient directions to use it in an atomizer for home treatment, and increase to a 10-per-cent. solution in office treatment, which can readily be done if the stronger preparation is employed in the vaporizer or nebulizer (Figs 13 and 14), at first, and afterward in a coarser spray (Fig. 12).

Aristol is preferable to most other powders, for its local anæsthetic and adherent qualities. Aconite in glycerin, a salol- or antipyrin- spray, or guaiacol applications diluted with glycerin at first, pure afterward, are indicated if a rheumatic or gouty condition exist. Added to these, sodium salicylate, salicin, antipyrin, and lithium are effective in ridding the system of the uricacidæmia that may lie at the root of the trouble.

If the case is of an hysterical nature, sedatives and tonics are required: valerian, the bromides, strychnia, arsenic, iron, etc.

ANÆSTHESIA.

Loss of sensation is of less import than its exaltation, since it is not accompanied with like suffering. It is sometimes a sequel of diphtheria or insanity. Nerve-tonics, such as are mentioned above, and galvanization are indicated.

PARÆSTHESIA.

Patients sometimes experience the sensation as if some foreign body were in the throat, when it is impossible to make out either the presence of such foreign body or any evidence that it may have at any time found lodgment. Indeed, no abnormal condition whatever of the pharynx is discernible. This condition obtains in hysterical individuals, and it is difficult to satisfy them that they are mistaken. This manifestation is purely of a neurotic character and must be treated accordingly.

Treatment.—Such methods as are recommended for hyperæsthesia are appropriate here,—nerve-stimulants, tonics, or sedatives, as the particular features of the case may demand.

NEURALGIA.

While painful sensations in the pharynx are sometimes attributable to inflamed follicles, uric-acid irritation and various local lesions, there is a class of cases in which pain is experienced without the presence of any visible morbid process to account for it. This occurs in hysteria and is very difficult to influence.

Treatment.—If any local lesion can be discovered it must be treated according to the principles already laid down, but when the pain is purely neurotic, topical applications to the sensitive or painful spot, if it can be located, and nervines, sedatives, and tonics, as set forth in treating of hyperæsthesia, must be brought into requisition.

NEUROSES OF MOTION.

Two kinds of neuroses of motion are met with: spasms and paralysis.

SPASMS.

Spasmodic contractions of the pharyngeal muscles may be excited by any local irritant: traumatic, such as harsh particles of food;

or idiopathic, such as inflamed follicles; or the affection may be purely neurotic, such, for example, as globus hystericus. The levator palati muscle is occasionally subject to choreic attacks, in which the soft palate is thrown against the wall of the pharynx with more or less regular contractions and relaxations, accompanied by objective smacking or crackling sounds. These spasms may be associated with serious and grave neuroses, as well as with inflammatory conditions of the soft palate. Central nervous lesions and hydrophobia are characterized by this symptom.

Treatment.—If pharyngeal spasm can be traced to inflammation of the velum or œdema of the uvula, the proper treatment already outlined for these conditions will afford relief. Anomalous conditions of the nasal cavity must be searched for, and inflamed follicles in the pharynx that might provoke the attacks. Any local diseased condition must be corrected. When the contractions are dependent upon other maladies the treatment must naturally be addressed to the initial affection, such as brain-tumors and hydrophobia, for the spasms constitute a symptom only of such diseases. Diffusive nerve-stimulants, tonics, and hygienic and dietetic measures appropriate to each case will be suggested by the conditions present.

PARALYSIS OF THE PHARYNX.

Paralysis of the muscles of the pharynx results from diphtheria, syphilis, some central nervous lesion, or the fatal fevers. All the pharyngeal constrictor muscles may be involved or the disease may affect only one, or the muscles of one side alone are sometimes involved. There may be paralysis of one-half and paresis only of the opposite half of the pharynx.

Swallowing and speech are more or less impaired, according to the extent of the paralysis. Food, and especially liquids, regurgitate into the posterior nares or enter the larynx. The latter accident is the more likely to occur when the epiglottis is included in the paralytic condition.

Treatment.—The therapeutic measures will be determined by the nature of the lesion on which the paralysis depends. If it is a sequel of diphtheria, strychnia and arsenic are indicated. Excellent results have been reported from the subcutaneous injections of strychnine. In addition to tonics we prefer for such conditions a current from the primary coil of a faradic battery, which, as the galvanometer demonstrates, possesses galvanic properties. This will cause contractions of the muscles if the disease has its origin in the nervous centres, but in case of atrophy of the muscles they do not respond to the current. The condition in the latter case is unpromising. In addition to electrical treatment three or four times a week, general tonic remedies are usually called for.

Burns and Scalds of the Pharynx.

The pharynx is the seat of injury from inhaling very hot steam, air, or smoke, especially in burning buildings. Firemen are particularly subject to these accidents. Children sometimes inhale steam from a tea-pot or tea-kettle or pour hot liquids down their throats. Patients and nurses by mistake give escharotic fluids instead of the correct internal medicine. I have had patients whose throats were severely burned by aqua ammonia and carbolic acid in strong solutions that were administered by mistake from bottles standing beside those containing the proper remedies.

Symptomatology.—Immediately after these accidents the mucous membrane of the throat is of a gray color, produced by the destructive agent. Inflammation follows, with more or less suppuration and sloughing of the tissues.

Diagnosis.—This is usually made by the patient or his friends before the arrival of the physician.

Prognosis.—Firemen and persons caught in burning buildings are often so seriously burned by inhaling heat, hot smoke, and steam that recovery is impossible. There may be such an extensive breaking down of the tissues in the throat as to have a stenosis if recovery take place.

Treatment.—Icebags (Fig. 194), cool drinks, or pellets of pure ice in the mouth afford some relief and tend to modify the severity of the inflammation. Nourishment may have to be given for a time per rectum. When the larynx is involved to the extent of impending suffocation, tracheotomy must be performed at once.

Foreign Bodies in the Pharynx.

It is not uncommon to find fish-bones, pins, needles, and bristles, among sharp-pointed articles, lodged in the walls of the pharynx. As the constrictor muscles contract about them, they are forced into the soft tissues, until in some instances they escape detection on first looking into the throat. I have found such bodies as sections of juniper-leaves, etc., so imbedded as to be extracted with the greatest difficulty. This is especially true when they have remained for a number of days in the throat, exciting continued efforts at swallowing and setting up an intense congestion and swelling of all the surrounding structures.

Besides articles of a sharp, piercing nature that penetrate the tissues, bodies like unmasticated boluses of food and coins occasionally slip into the gullet and threaten strangulation.

Symptomatology.—Sharp bodies are generally arrested in their progress by being caught in the lateral walls of the pharynx, where they will be found projecting from the tissues which they have penetrated. Small bodies are likely to lodge on one side of the epiglottis in the pyriform sinus. The large boluses of food, coins, etc., are arrested at a point just posterior to the larynx or a little superior to it, and are very liable to catch upon the epiglottis and force it downward. Little bodies often drop into the pyriform sinus or the glosso-epiglottic fossa.

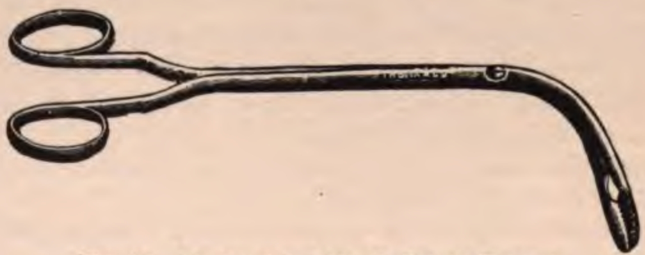


Fig. 85.—Mackenzie's Lateral Throat Forceps.

The symptoms produced by foreign bodies in the throat are sometimes very distressing and even dangerous. If the epiglottis is forced downward so as to close the entrance to the larynx the patient may suffocate before relief arrives. When sharp articles stick in the throat they produce a pricking sensation, which increases during the act of swallowing. Pebbles, buttons, and the like may remain secreted in the pyriform sinuses for a considerable time without giving rise to serious inconvenience.

It often happens that when crusts of bread and other hard substances are swallowed they scratch the mucous membrane of the throat, and this abrasion, giving rise to irritation, produces the impression in the mind of the patient that a foreign body is present. I have known them to insist strenuously upon the presence of some substance; but an application of a 4-per-cent. solution of cocaine to the irritated area removed it apparently. There is also a similar sensation due to a point of irritation which may be found to exist in an inflamed follicle.

Certain susceptible persons occasionally believe they are afflicted with a foreign substance in the throat when the trouble is purely a nervous one,—globus hystericus.

Treatment.—Sometimes foreign bodies can be seen by depressing the tongue, but generally the laryngeal mirror is necessary. Remembering what has been said about the points of lodgment of the various kinds of bodies, and ascertaining, if possible, from the patient what the object was most likely to have been, the search is much facilitated. Sometimes it is best to insert the finger to locate the body, and it may be possible to extract it during this examination.

Long, curved forceps are best adapted to this use (Fig. 85). One should be careful to not wound the adjacent tissues in the effort to grasp the foreign body.

In extreme cases it may become necessary to open the trachea in order that respiration may proceed until the body can be rescued. A bolus of food may be forced down into the œsophagus if it cannot be extracted. Considerable irritation or inflammation follows these accidents.

PART III.

Diseases of the Larynx.

PLATE V.

PLATE V.

ANATOMY OF THE LARYNX.

FIGS. 1 TO 9.

a, Thyroid cartilage.
b, Cricoid cartilage.
c, Arytenoid cartilage.
d, Cartilage of Santorini.
e, Cricothyroid membrane.
f, Vocal band.
g, Arytenoideus muscle.
h, Lateral cricoarytenoid muscle.
i, Posterior cricoarytenoid muscle.
j, Epiglottis.
k, Vocal process.
m, Cartilage of Wrisberg.
n, Aryteno-epiglottic fold.
o^1, Upper fasciculus of thyro-arytenoid muscle.
o^2, Middle fasciculus of thyro-arytenoid muscle.
o^3, Lower fasciculus of thyro-arytenoid muscle.
p, Ventricle of the larynx.
q, Laryngeal sac.
r, Ventricular band.
s, Superior aryteno-epiglottic muscle.
t, t^2, Two fasciculi of thyrocricoid muscle.
u, Superior thyro-arytenoid ligament.

ABDUCTION AND ADDUCTION.

FIG. 1.

POSTERIOR VIEW.

Vocal bands abducted by contraction of posterior crico-arytenoids (arytenoideus cut off).

FIG. 2.

LATERAL VIEW.

Section of larynx showing the relation of adductor and abductor muscles.

FIG. 3.

POSTERIOR VIEW.

Vocal bands adducted partially by contraction of lateral cricoarytenoids (arytenoideus not having acted).

FIG. 4. FIG. 5.

HORIZONTAL SECTION OF LARYNGEAL FRAMEWORK, ABOVE VOCAL BANDS.

Vocal bands in abduction. Vocal bands in partial adduction.

EXTENSION AND RELAXATION.

FIG. 6.

LATERAL SECTION.

Relaxation of vocal band through contraction of thyro-arytenoids and relaxation of thyrocricoids.

FIG. 7.

LATERAL SECTION.

Interior of larynx. Flaps raised to show laryngeal sac, and the relation of muscles with the mucous membrane.

FIG. 9.

ANTERIOR SECTION.

Interior of larynx and relation of muscles.

FIG. 8.

LATERAL SECTION.

Extension of vocal band by elevation of the cricoid cartilage through contraction of the thyrocricoid muscles and relaxation of the thyro-arytenoids.

FIG. 10.

INNERVATION OF THE LARYNX.

Posterior section of neck and upper part of chest, showing the course of the pneumogastric nerves, their branches, and their relations. Lateral half of trachea and quarter of larynx cut off.

A, A^1, Pneumogastric nerve.
B, B^1, Superior laryngeal.
C, Right recurrent laryngeal.
D, Right lung.
E, Left recurrent laryngeal.
F, Branch of superior laryngeal.
a, Œsophagus.
b, Aorta.
c, Pulmonary artery.
d, Trachea.
e (upper), Internal jugular vein cut off.
e (lower), Bronchi.
f, Arytenoid cartilage.
g, Subclavian artery.
h, Common carotid artery.
i, External carotid artery.
j, Internal carotid artery.
k, Base of cranium.
m (upper), First cervical vertebra.
m (lower), Arytenoideus muscle.
n, Pharynx cut off from upper attachments.
o, Epiglottis.
p, Hyoid bone.
q, Thyroid cartilage.
r, Cricoid cartilage.
s, Thyroid gland.
u, Thyrocricoid muscle.
v, Cervical vertebræ.
x, *y*, Muscles of neck.
z, Innominate artery.

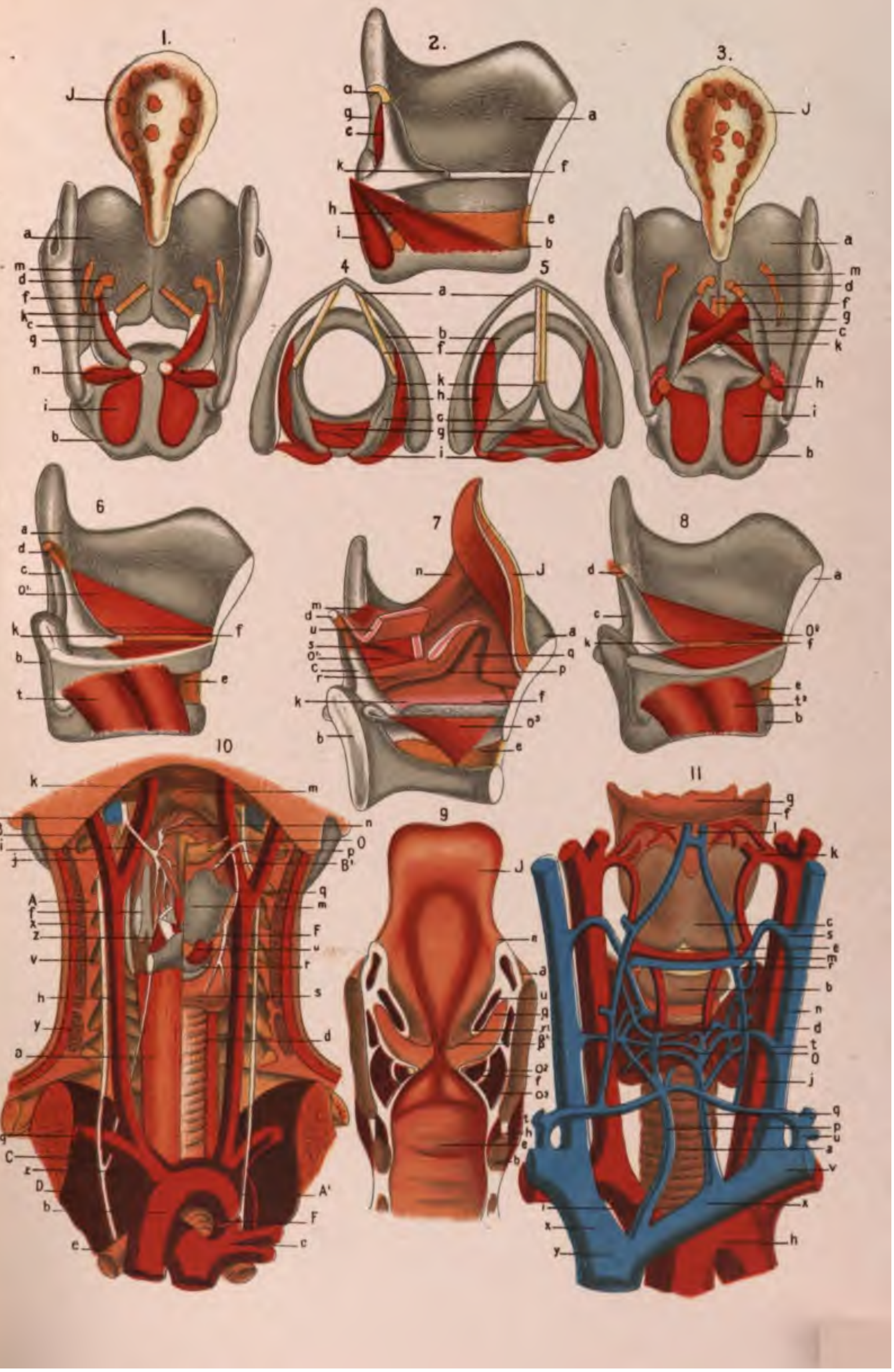
FIG. 11.

ARTERIES AND VEINS OF THE ANTERIOR PORTION OF THE NECK.

Vessels of the neck, showing those in danger of being severed in making artificial opening into the larynx and trachea, and their connections.

a, Trachea.
b, Cricoid cartilage.
c, Thyroid cartilage.
d, Thyroid gland.
e, Cricothyroid membrane.
f, Thyrohyoid membrane.
g, Hyoid bone.
h, Aorta.
i, Innominate artery.
j, Common carotid artery.
k, Superior thyroid artery.
l, Anterior jugular vein.
m, Cricothyroid artery.
n, Internal jugular vein.
o, Thyroid plexus.
p, Right inferior jugular vein.
q, Left inferior jugular vein.
r, Cricothyroid vein.
s, Superior thyroid vein.
t, Middle thyroid vein.
u, External jugular vein.
v, Subclavian vein.
x, Right and left innominate vein.
y, Superior vena cava.

PLATE. V.


1.
J
a
m
d
f
k
c
g
n
i
b
2.
a
g
c
k
h
i
a
f
e
b
3.
J
a
m
d
f
g
c
k
h
i
b
4
5
a
b
f
k
h
c
g
i
6
a
d
c
O^1
k
b
t
f
e
7
n
J
m
d
u
s
O^1
c
r
k
b
a
q
p
f
O^3
e
8
d
c
k
a
O^2
f
e
t^2
b
10
k
e
B
i
j
A
f
x
z
v
h
y
a
q
C
z
D
b
e
m
n
O
p
B'
q
m
F
u
r
s
d
A'
F
c
9
J
n
a
u
g
γ'
β'
β
O^2
f
O^3
t
h
e
b
11
g
f
l
k
c
s
e
m
r
b
n
d
t
O
j
q
p
u
a
v
x
h
i
x
y

CHAPTER XX.

DISEASES OF THE LARYNX.

Indirect Laryngoscopy and Instruments.

Examination of the interior of the larynx, commonly called laryngoscopy, is made by means of a light reflected into the larynx through the medium of two mirrors. The first, or forehead-, mirror is illustrated in Fig. 110, and is used in the same manner as in otoscopy and rhinoscopy, described elsewhere. The second mirror, sometimes dignified by the name of laryngoscope, consists of a circular plane-glass mirror inclosed in a metallic frame, to which is attached a wire handle set at an angle of 120 degrees to the plane of the mirror (Fig. 5). It is made in several sizes, but those most commonly employed vary from one inch (twenty-five millimetres) to one-half inch (twelve millimetres) in diameter. The most perfect view is obtained by using as large a mirror as the proportions of the throat will permit without contact between mirror and mucous membrane. The sizes are numbered according to their diameters, No. 1 being one inch (twenty-five millimetres) wide, and the others graded by one-eighth-inch (three millimetres) variations down to one-half inch (twelve millimetres), and numbered accordingly. In the capacious throats of adults the largest size is to be used, while in children the smaller ones are necessary.

For the purposes of illumination there are various devices for projecting the rays of light upon the laryngeal mirror. Fig. 86 shows an ingenious device of Allen De Vilbiss, which is a modification of Mackenzie's light-concentrater. It is simpler in construction than Tobold's apparatus, although it is similar to it. It is provided with two mirrors, one plane and the other concave, both of which are attached to a stationary mirror-bar by means of ball-and-socket joints, so arranged that they may be easily changed to any position on the bar and inclined at any angle.

The plane mirror enables the physician to show his patient the condition of the affected parts, and, if needing treatment, illustrate its necessity. "By this method patients may see the extent and nature of their diseases and receive treatment when they might otherwise consider it of but little importance, not demanding medical assistance." If deemed advisable, the patient may be shown, from time to time, the changing condition of his disease, and thus be kept interested in its treatment. By this device the patient can see to keep himself "in light," thus relieving the physician from the necessity of frequently adjusting the mirror. This laryngoscope can be adjusted to a student's lamp, and may be raised or lowered by means of a single set-screw. Fig. 111 shows another adjustable lamp.

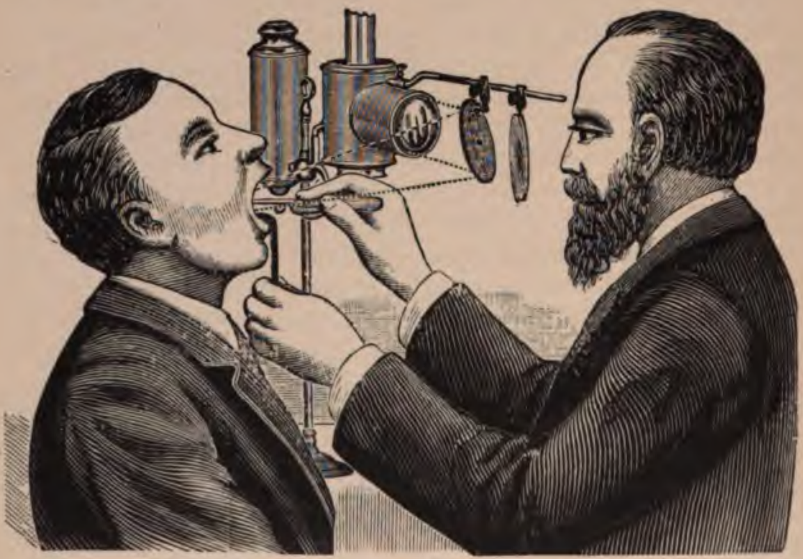


Fig. 86.—De Vilbiss Illuminator.

Assuming that we have proper illumination, the examination proceeds as follows: The patient and examiner being in the relative positions illustrated in Fig. 86, with the patient's mouth open, the tip of his tongue is taken between the physician's thumb and index finger, protected from actual contact with the tongue by a napkin or thin towel, and the tongue is held protruded from the mouth. The patient should not make an effort to force the tongue forward nor to retract it, but should let it lie passively in the surgeon's control. This is necessary in order to raise the epiglottis and expose the aperture of the larynx. This is effected by traction on the glosso-epiglottic ligament, which happens in the drawing forward of the tongue. Unless the examiner is careful in this act he will wound the frænum on the sharp edges of the lower incisor teeth. It is advantageous to instruct the patient to assist in his examination by holding his tongue himself, using the hand opposite to the one used by the examiner, so as not to be in the way of the laryngeal mirror as it is introduced.

The light is now focused on the uvula, and the front of the laryngeal mirror is exposed for only an instant over a flame to warm it. This must be done in order to prevent the moisture of the breath from condensing upon the glass and blurring the laryngeal image. After a second of warming the mirror it is touched to the surgeon's cheek, or a sensitive part of his hand, to determine if the heat is sufficient to avoid condensation. If the flame is very hot, or if the mirror is exposed to it during too long an interval, the silver, or other backing of the glass, is fused, and the instrument destroyed. Glass being a poor conductor of heat, there is less danger of melting the coating of the back if the glass itself is held toward the source of heat.

The laryngeal mirror now being ready for introduction, it is held like a pencil, and without loss of time, which would allow the mirror to cool, it is carried into the throat in such a way as to avoid contact with the tongue and surrounding parts, so as not to cause nausea and retching. The back of the mirror is made to impinge upon the anterior surface of the uvula and to carry the latter upward and backward. The mirror is then turned so as to reflect the rays of light from the forehead-mirror into the cavity of the larynx, when an image of the interior of the larynx and the superior portion of the trachea will come into view. The patient should be told that no pain will be caused, and that he should remain perfectly passive and breathe quietly. If he is able to accommodate himself to the situation, an opportunity is given to study the vocal cords, which are seen in an abducted relation, of a white color, about three-fourths of an inch (two centimetres) long, and diverging from the upper to the lower ends, as seen in the reflected image (Plates I and IV).

If the subject is caused to utter a broad, open sound, represented by the syllable "ah," as used by vocalists in developing their voices, the vocal bands approximate each other and become parallel, with only a narrow slit intervening between them. As seen before vocalization, the vocal bands are concealed largely from view by the ventricular bands, only their borders being then visible.

One should not forget that he is not looking directly at the contents of the larynx, but at an image of them in a mirror, which, of course, reverses the picture to the observer; or, in other words, the examiner sees the picture as he would if his eye were behind and above the larynx,—the position occupied by the mirror. The epiglottis appears in the upper section of the mirror as a yellowish-pink valve, showing on its surface a map of minute blood-vessels. Its outline is suggestive of a Cupid's bow, with the convex surface directed upward. Just below this bow is seen the anterior commissure of the vocal cords, which is narrower than the posterior commissure, as shown in the lower part of the image. The right vocal band appears in the left field of the image and the left is reflected in the right side of the picture. From the right and left termini of the bow-shaped borders of the epiglottis spring the aryepiglottic folds, curving gracefully inward to meet each other in the form of a horseshoe, and completing the superior boundary of the opening into the larynx by their union in the arytenoid commissure (Plate IV). On either side of the junction of the aryepiglottic folds is a nodular eminence called the cartilage of Santorini, and immediately to the outside of these knobs, on either side and slightly elevated above them, is a bulbous-appearing prominence,—the cartilage of Wrisberg. These eminences are of a redder hue than the epiglottis. Below them are seen the ventricular bands, which spring from an area corresponding to the junction of the cartilages of Santorini and Wrisberg (Plate IV, Fig. 9).

The junction of the ventricular bands in front, their anterior commissure, is concealed by an eminence,—the cushion of the epiglottis. The vocal bands or cords appear below the ventricular bands, extending from below the cushion of the epiglottis to points just inferior to the cartilages of Santorini. Between the ventricular band and vocal cord is a dark aperture termed the ventricle of the larynx. Beyond all these structures appear the rings of the trachea. From three to six are usually in sight, and sometimes a view of the whole length of the trachea to the branch of the right bronchus is obtained. For the anatomy of the larynx see Plate V. The various images resulting from correct and incorrect methods of examination are illustrated in Plate VI.

DIFFICULTIES OF LARYNGOSCOPY.

Laryngoscopic examinations are not without considerable obstacles in many instances. Although there are individuals with capacious throats devoid of sensitiveness, who readily co-operate so as to afford a broad-gauge view of the interior of the larynx and trachea, there are frequently persons who have little or no control of their muscles, and who retch and gag, and even vomit, when an attempt is made at laryngoscopy. In such cases it may become necessary to inure the throat to the presence of foreign bodies by the practice, on the part of the patient, of inserting smooth, blunt articles, such as spoon-handles and the like, daily at home. In this manner a tolerance of instruments may be cultivated to such a degree as to render successful subsequent attempts at an examination.

When repeated efforts fail on account of hypersensitiveness of the throat, it is necessary to bring to our aid a 4-per-cent. solution of cocaine or eucaine. This is painted over the base of the tongue and the soft palate, and in a few minutes the sensibilities of the nerves are so benumbed as to permit of a thorough inspection with the mirror.

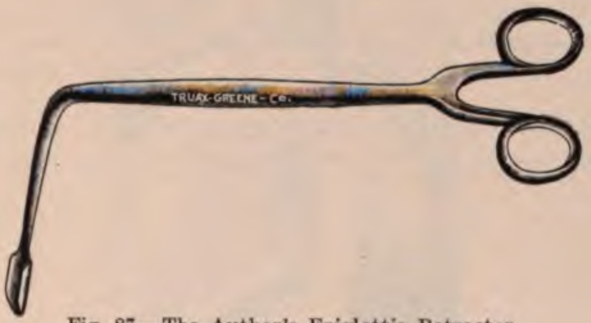


Fig. 87.—The Author's Epiglottis Retractor.

Another instance in which it may become necessary to employ a local anæsthetic is when the epiglottis is pendent to the degree of obstructing the rays of light and preventing their penetrating the laryngeal cavity. In this condition the epiglottis must be raised and pressed forward out of the field of vision by a retractor (Fig. 87). In order to do so without producing pain and gagging the epiglottis may be treated to the cocaine solution.

Fig. 87 illustrates an epiglottis retractor designed for use in cases in which it is impossible to obtain a good view of the interior of the larynx without holding the epiglottis upward and forward. The spade-like blade which rests on the posterior or under surface of the epiglottis is sufficiently wide to produce a certain degree of a flattening effect on an omega-shaped epiglottis, thus facilitating laryngoscopy in two ways. A firm control over the retractor is given by the employment of the double-ring handle, such as is used in the biting forceps.

The tongue is often forced upward and shuts off the view if the mirror comes in contact with it and produces gagging. The patient is told not to strain, and the tongue is not drawn forcibly forward. If then the arching of the tongue does not recede, the tongue-depressor must be employed. If the mirror is held by the right hand, the tongue-depressor is held by the left in such a way that the instrument intervenes between the thumb and the tongue, and the first finger rests under the tip of the tongue. The depressor must not be carried far enough backward to provoke nausea and retching. It is better still to instruct the patient to hold his own tongue, so as to leave both hands of the surgeon free.

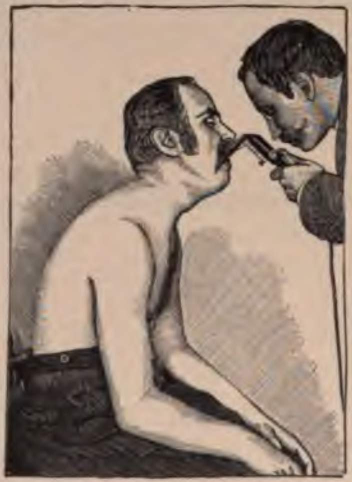


Fig. 88.—Position for Autoscopy. (Thorner.) This photograph was taken from a partly stripped patient in order to show distinctly the position of head and neck during examination.

When the tonsils are enlarged they so encroach upon the lumen of the cavity as to interfere with a satisfactory laryngoscopy. Then a small mirror must be resorted to; but tonsils sufficiently hypertrophied to embarrass an examination of the larynx ought to be clipped.

DIRECT LARYNGOSCOPY.

Max Thorner has called the attention of American laryngologists to a method of examining the larynx and trachea without the laryngoscopic mirror. In a paper on this subject in *The Laryngoscope* for February, 1897, and in a translation of a monograph by Alfred Kirstein, of Berlin, on Autoscopy of the Larynx and Trachea, 1897, the method and instruments are described and illustrated in detail.

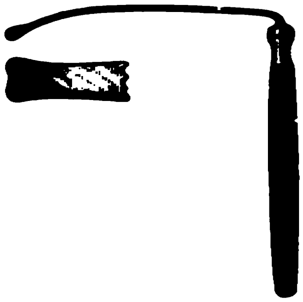


Fig. 60.—Tongue-depressor for Pharyngoscopy and Direct Laryngo-tracheoscopy. (Thorner.) Side-view and surface-view of the anterior portion. In some cases an instrument with a larger curve of the anterior portion is more practicable.

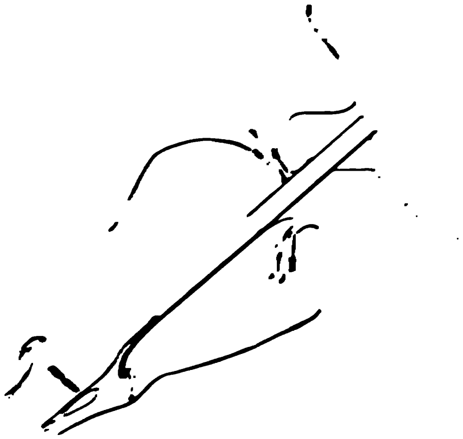


Fig. 61.—Tangential Plate. (Thorner.)

The method consists essentially in pressing the tongue forward and downward until the axis of the laryngo-tracheal tube and that of the buccal cavity coincide with each other. This is effected, first, by having the patient incline the upper part of his body a little forward, and the face slightly upward, with his mouth open (Fig. 88). The garments about the neck should be loose, and if false teeth are worn they must be removed before the introduction of the specially constructed spatula or the electroscope. Second, the physician, standing before the patient, passes the spatula, having a downward curve at the inserted extremity (Fig. 89) behind the circumvallate papillæ, and downward to the root of the tongue. The epiglottis is then elevated by the method described in 1879 by Reichert: "Pressure upon the base of the tongue and the median glosso-epiglottic ligament produces an elevation of the epiglottis on account of its close attachment to the tongue."

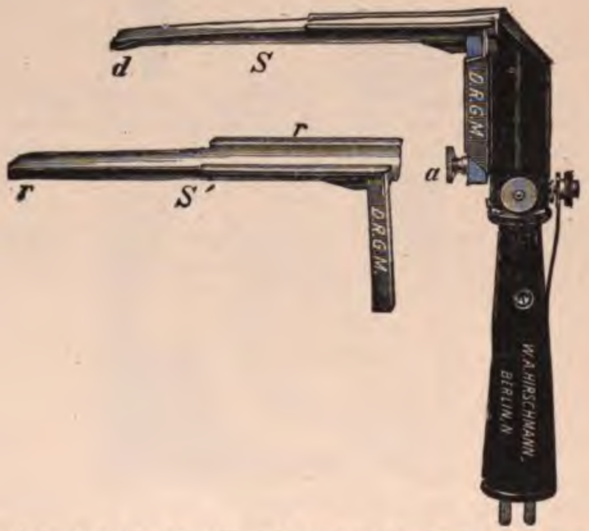


Fig. 91.—Standard Spatula (*S*), Attached to the Electroscope, and Intralaryngeal Spatula (*S′*), both with Hoods Omitted. (Thorner.)

So, with the patient in the position described, and the spatula introduced, the tongue is pressed downward and forward, the epiglottis at the same time is brought upward and forward until a straight line in the groove of the autoscope coincides with the longitudinal axis of the laryngo-tracheal canal (Fig. 90). This brings the cavity of the larynx and the trachea to the bronchial bifurcation into direct view. The posterior wall of the larynx is easily inspected, but the anterior commissure, the ventricles of Morgagni, and the pyriform sinuses are not within range of vision, and must be left for examination with the laryngoscopic mirror.

A prerequisite to successful "autoscopy" is that the rays of light be projected from the forehead into the throat, preferably by the electric head-light or by the electroscope (Fig. 91). The latter is a modification of Casper's instrument for inspecting the urethra. It has a handle containing an electric lamp, and a lens which focuses the light upon a prism, which, in turn, deflects the rays 90 degrees. The light is reflected in this manner along the spatula of the electroscope into the laryngeal cavity. The examiner looks over the prism and sees the contents of the larynx and trachea directly, just as he sees the nasal cavities in anterior rhinoscopy.

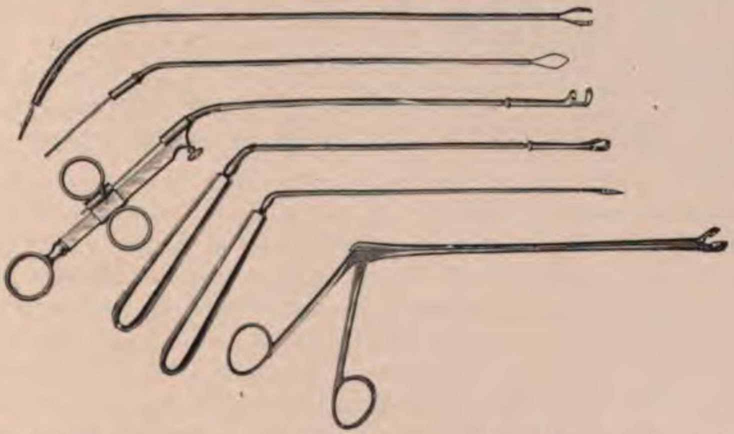


Fig. 92.—Types of Instruments for Autoscopic Operations. (Thorner.)

While it is not claimed by Thorner or Kirstein that this method should supplant the use of the laryngoscopic mirror, they assert for it certain advantages, which may be summarized as follow: Direct laryngoscopy gives a more realistic view of the organs inspected, in regard to both the normal color and the absence of reversal of the picture, both of which are important considerations in operative procedures; the posterior wall of the larynx and the deep portion of the trachea are subject to inspection; operations on the larynx and trachea are performed with greater exactness and facility under direct linear inspection.

Thorner regards this method of direct laryngoscopy "the most important addition to our technical resources since the discovery of the laryngoscope by Garcia." It is evident that the obliteration of the obtuse angle formed by the intersecting axes of the buccal cavity and the laryngo-tracheal tube, by rendering these axes coincident, calls for instruments without the curve that characterizes those commonly employed. Operations by the new method require that instruments be constructed after the types shown in Fig. 92.

Inspection with the autoscope—an unfortunate choice of name, since it is likely to be confounded with the word otoscope in speaking—necessitates monocular vision. About 50 per cent. of patients cannot be examined by this method. It requires considerable self-possession on the part of the patient as well as much practice on the part of the surgeon. Both Kirstein and Thorner concede that it should supplement, but not supplant, the use of the laryngoscopic mirror.

CHAPTER XXI.

DISEASES OF THE LARYNX *(Continued).*

ACUTE LARYNGITIS.

Synonyms.—Acute catarrh of the larynx; spurious croup.

Pathology.—Acute inflammation of the mucous membrane lining the laryngeal cavity (Plate VI) is characterized by an engorgement of the blood-vessels,—an hyperæmia,—accompanied, at first, by dryness of the membrane and afterward by an exudation of serum upon the mucosa, mixed with undeveloped epithelial cells and white corpuscles. The thin, translucent secretion soon gives place to a more copious secretion of a thick, opalescent, mucoid character, studded with desquamated epithelium, pus-corpuscles, and traces of blood. Points of denudation of the mucous membrane are generally present, but the submucosa is rarely invaded by ulceration in this affection.

Etiology.—Exposure to cold is the most common cause of this inflammation. Sudden changes from warm, ill-ventilated apartments to a cold, damp, or windy atmosphere when the subject is in a perspiration or insufficiently clad are frequently followed by laryngitis. This is most commonly seen during the changes of the seasons from fall to winter and from winter to spring. The inhalation of irritating gases such as are often generated in laboratories may excite a catarrhal condition of the larynx. Dust of certain kinds is a causative factor. Persons riding over the alkali deserts or plains of the western part of the United States are sufferers from rhinitis, laryngitis, and conjunctivitis, occasioned by the irritating effects of the great quantities of alkali-dust in those regions. Overtaxing the voice and its improper use by singers and speakers induce attacks of acute laryngitis. Instances of this affection are very common during political campaigns, when stump-speakers are driven from the field by the inordinate use of their vocal organs. Firemen—who shout in the heat and smoke of burning buildings, and who often inhale much of the hot air, steam, and smoke—are subject to this disease. The uric-acid diathesis, rheumatic and gouty conditions, and the eruptive diseases stand in a causative relation to acute laryngitis.

Symptomatology. — The premonitory symptoms of acute laryngitis may be so vague and trivial as to scarcely arrest the attention of the subject. A slight feeling of dryness, as though the air inhaled were devoid of moisture, and, therefore, irritating, is generally the first unusual condition noticed. This is likely to be followed by a scratching or tickling sensation that excites efforts to relieve it by clearing the throat or coughing, which, instead of relieving the irritation, only adds to the feeling of roughness. A sense of constriction or of soreness soon follows, but palpation of the larynx seldom develops tenderness, except in rheumatic attacks. As the disease progresses and the vocal cords become involved, the voice changes in quality, or timbre. It takes on a rough, husky, or hoarse, character, which has the effect of apparently lowering its pitch.

About this time discomfort in swallowing occurs, amounting to a very painful effort. This is especially the case in the rheumatic form of the disease, and with the accentuated painfulness of deglutition may come a complete loss of voice, so that the only speech possible to the patient is a forced whisper. Cough is not necessarily a symptom of acute laryngitis, but is frequtently present. Its hoarse character is indicative of the location of the causative lesion in the larynx. Auscultation of the larynx will demonstrate the presence of mucous râles. These are not heard during the initiatory stage, in which the mucous membrane is dryer than it is in the normal state; but later, as the serous exudate and mucus bathe the walls of the larynx, the passing of air through these fluids gives rise to easily detected râles. The expectoration is characterized by the presence of the secretions just mentioned, and later in the disease by the presence of pus, possibly streaked with blood. The presence of blood, however, is generally an accidental and unusual feature, being the result of a very violent fit of coughing, or, perhaps, of vomiting.

Acute laryngitis does not usually give rise to very serious general disturbances of the system in adults, but it often presents alarming symptoms in children. As all diseases produce a more profound impression during the early years of life than in adults, so acute laryngitis may evoke such violent symptoms as to fill the patient and friends with terror. The temperature rises; the pulse becomes accelerated, bounding, and hard, and the tongue is heavily coated. Even when the little patient appears during the day to have no serious sickness, he may awaken at night with a suffocative attack out of all proportion to the apparent cause. The respiration is embarrassed and the respiratory effort is marked by an audible, stridulous sound. The cough reveals a changed voice, hoarse and husky, and the diminished oxygenation of the blood and the frantic efforts to overcome the obstruction to breathing bring on a swollen and congested appearance of the face.

These attacks are sometimes called stridulous laryngitis, and they are probably occasioned by the drying of accumulated discharges in the glottis. The child breathes through his open mouth, with the result that the air entering the larynx and lungs is not moistened by the secretions of the nose, as it is in normal respiration. Consequently the dry air causes rapid evaporation of the water of the laryngeal secretions, with the effect of causing them to dry upon the vocal cords until they offer a positive obstacle to the current of inspired air. When the obstruction has existed long enough to cause actual distress the patient awakens in a frightful state of impending strangulation. Soon, however, the active efforts of the patient to dislodge the inspissated secretions relieve the stenosis and restore free respiration, when calm succeeds the storm.

The attacks described here have been attributed by some authors to a spasm of the adductors of the vocal bands. This spasmodic contraction may play a rôle as a complication, but the mechanical explanation is reasonable; all the elements requisite to the production of such attacks are present; and it so conforms to our experience with similar conditions in other situations as not to necessitate an exercise of the imagination to account for all the phenomena observed.

Inspection of the larynx during an attack of acute inflammation reveals a mucous lining of a bright-red color (Plate VI). The congested condition may be limited to various portions of the membrane, but usually it is diffused over the whole surface. There is a tumefied condition in severe forms of inflammation, and the ventricular bands may be so swollen as to override the true vocal bands and nearly occlude them from view. Then they are seen as slight, reddened lines below the ventricular bands. Ulcerations are not frequently seen, but small spots of the membrane denuded of its epithelium may be present. The epiglottis may participate in the inflammation, as shown in Plate VI, or it may not be involved.

Œdema occurring in the course of laryngitis constitutes a grave complication, since it may give rise to fatal stenosis (Plate VI).

Diagnosis.—In adults no serious difficulty to a diagnosis presents, in view of all the symptoms related. It is not likely to be confounded with diphtheria except in children, when it may be mistaken for true croup. In case of doubt, an examination of the fauces will likely reveal false membrane if diphtheria is present. A laryngoscopic examination should be had if obtainable. The secretions should be subjected to bacteriological examinations if there is reason to suspect diphtheria. However, this disease does not run such a course as does diphtheria and it is not attended with the symptoms of profound sickness comparable to those of diphtheria.

Prognosis.—This disease is of short duration and yields readily to proper treatment.

Treatment. — Local remedies are useful as detergents, astringents, anæsthetics, protectives, and tonics. A spray of a mild alkaline solution with antiseptic properties, such as Dobell's, will dissolve and wash away the discharges, and, besides leaving the mucous membrane clear and free for the application of other medicaments, the effect is a very agreeable and soothing one. In the dry stage the author has found menthol very efficient when inhaled in several different ways. If no atomizer is at hand, the crystals can be fused in a teaspoon over a lamp or stove until the atmosphere of a small room is comfortably impregnated with the volatile fumes. The patient is directed to keep his eyes closed to prevent any smarting, and, unless his nostrils participate in the inflammation, he is instructed to breathe through the mouth. The inhalation starts a refreshing flow of mucus to bathe the parched membrane of the dry stage. Another excellent treatment consists in putting 10 drops of pure camphor-menthol into a half-pint of hot water contained in a hot-water inhaler (Fig. 22) or in a tea-pot or kettle, wrapping a napkin around the nozzle to prevent burning the lips, and then inhaling this medicated steam through the mouth with the lips embracing the nozzle. The hot, moist steam has an excellent effect, in addition to the action of the camphor-menthol, in contracting the capillary blood-vessels and producing a slightly anæsthetic and antiseptic effect.

Cocaine and silver nitrate are recommended by some writers and are used much oftener than they ought to be. They are to be avoided in acute laryngitis.

The writer has found his throat tablets useful, and they can be given freely, without producing any unpleasant consequences, except, perhaps, nausea. Each tablet contains 1 grain of ammonium chloride and the equivalents of 5 minims each of paregoric, compound syrup of squills, and syrup of Tolu, with 3 grains of extract of licorice. These are held in the mouth and allowed to dissolve slowly and trickle down the throat. Besides the desirable action of the ingredients of this tablet on the mucous membrane of the throat, the licorice generally produces a laxative effect on the bowels. J. D. Arnold recommends, in the case of superficial erosions, the use of cocaine, followed by painting the laryngeal mucous membrane with a 1- or 2-per-cent. solution of chromic acid. He employs the cocaine not for the purpose of anæsthesia, for this strength of chromic-acid solution is not painful, but to contract and deplete the blood-vessels, in which condition the action of the acid is more beneficial.

If the inflammation is of a severe grade, the icebag (Fig. 194) is indicated. Leeches to the neck are sometimes employed, but cold is preferable. Counter-irritation by mustard, tincture of iodine, aqua ammonia, chloroform, etc., is useful.

General treatment consists, first, in putting the patient in such a condition as is favorable to successful treatment. He need not necessarily be put to bed, but he had best remain in-doors for a few days, where the temperature is uniform and where he will not be exposed to those conditions that brought on the attack. In the dry, or first, stage, $^1/_6$ or even $^1/_3$ grain of pilocarpine is useful to stimulate the sudoriferous and salivary glands to activity. This is a substitute for the old-fashioned, dismal sweats that loom up in our memory of boyhood. Quinine—that much-abused remedy, given for almost every ill that afflicts our race—is of little or no use here, as far as my experience goes. One or two doses of morphia, $^1/_{12}$ grain, combined with atropia, $^1/_{600}$ grain, and caffeine, $^1/_6$ grain, have often appeared to greatly ameliorate, and even shorten, the attacks materially. Irritants—tobacco-smoke, alcoholic liquors, etc.—must be forbidden.

If œdema be found, the tissues affected must be scarified, to let out the contents. Should the tumefaction and stenosis be so great as to seriously embarrass respiration or threaten suffocation, tracheotomy must be performed.

The rheumatic type of acute laryngitis is attended with considerable pain and difficult deglutition, that require promptly acting remedies. Ten-grain doses of salicylate of sodium every two hours should be given until either the symptoms begin to show signs of relief or the physiological action of the drug begins to manifest itself in stuffiness in the ears, diminished hearing, ringing noises in the ears, or gastric disturbances. Then the doses should be placed at greater intervals or discontinued until these transitory symptoms abate, and renewed again in smaller doses until after complete recovery. A fresh preparation should always be made, like the formula given in the article on the treatment of rheumatic pharyngitis (page 155). If the sodium salicylate disagrees with the stomach or produces serious aural symptoms, and more especially if the patient already has an affection of the ear, salicin should be substituted for the salicylate. I have seen 10 grains of salicin, taken every two hours, produce prompt relief before the expiration of a day. This effect is hastened if the same doses of effervescing citrate of lithia are taken three or four times a day. Antipyrin is often very beneficial in this disease, and the same may be said of salophen and salol.

Climate has a definite effect on the rheumatic form of laryngitis. I have known a patient suffering from it during a season of cold, humid, windy weather that prevailed along the Great Lakes Region, to go south, into a genial, warm, sunshiny climate, and recover from the attack, without medicine, after two days of life in the sunshine, so magic in their effects are climatic conditions.

CHAPTER XXII.

DISEASES OF THE LARYNX *(Continued).*

CROUP.

Synonyms.—Pseudomembranous croup; idiopathic membranous croup.

Pathology. — The question of the identity or duality of croup and laryngeal diphtheria is still a mooted one. Excellent authorities differ on this subject. So scholarly an author as Sir Morell Mackenzie believed the two to be identical. Both diseases affect the mucous membrane, with the result of producing a false membrane. Both diseases attack the same organ,—*i.e.*, the larynx. Both obstruct respiration. In these three particulars there is a close similarity in the two diseases, but the author is not prepared to admit their identity. Croup is primarily an affection of the larynx; diphtheria is generally at first an affection of the pharynx, although it may, in a certain percentage of cases, develop primarily in the larynx. "In one hundred and fifty-one diphtheric cases the membrane was limited to the larynx only once. In eighty-eight the membrane appeared first in the larynx or simultaneously with that of the pharynx" (Northrup). Croup is more frequent in the country, while diphtheria is more prevalent in cities.

In the opinion of the author, the wide differences between the unicists and dualists can be harmonized by recognizing what certainly appears to be pathologically and clinically true: that there are two varieties of membranous croup, the one diphtheric, the other non-diphtheric. "Out of two hundred and eighty-six cases of membranous croup, 80 per cent. were diphtheric and 14 per cent. were certainly not diphtheric" *(Medical Record).*

True croup is an idiopathic disease; diphtheria does not arise spontaneously, independently, in isolated instances without inoculation or infection, directly or indirectly, from a previously existing case of the disease, as croup does. The latter is not a contagious, inoculable disease; diphtheria is pre-eminently so. Croup does not infect the whole system with a profoundly depressing and exhausting poison, causing paralytic sequels, as the diphtheria toxin evolved by the Klebs-Löffler bacillus does. The clinical pictures of the two diseases are similar in their mechanical effects upon the respiration and consequent deoxygenation of the blood, but from that point their histories are not parallel. Their divergencies are apparent to one who has had much experience in their treatment. He must recognize that we have a laryngeal diphtheria, on the one hand, and a true croup, on the other. Porter agrees with this view, that there is a plastic exudation in the larynx which is not diphtheric.

This is a disease of childhood, and occurs most frequently about the second year, and from that to the tenth year.

Croup is an inflammation of the mucous membrane, usually confined to that part of the larynx superior to the vocal bands, but it may extend to the trachea. It is attended with the formation of an exudate, or inflammatory lymph, that is deposited in the form of a fibrinous membrane on the epiglottis, the ventricular bands, and to a greater or less extent upon the vocal cords. This false membrane does not penetrate the epithelial layer to the submucosa as the diphtheric membrane does, but it can be peeled off without tearing the mucous membrane or leaving a rough, raw, and bleeding or ulcerating surface. If the inflammation extend to the submucosa the laryngeal muscles become involved, resulting in spasms or paralysis.

Etiology.—This disease may arise primarily, without any discoverable exciting cause, or it may occasionally be secondary to injuries, irritants, scarlet fever, measles, small-pox, etc. Exposure to cold and moisture, especially combined with strong winds, may give rise to attacks. I have not observed that the previous condition of health exerted much influence for or against the production of croup. Healthy appearing children seemed to be as easily subject to it as those who were badly nourished. The author has had a considerable opportunity to study these subjects in his practice in connection with the children's departments of the South Side and of the West Side Free Dispensaries, and, while the children that most easily succumbed to diphtheria and other diseases were the feeble and strumous, he has seen the fat and rosy children as often attacked by croup as those with impoverished systems.

The chilling of children by exposing them to draughts of cold air; the unpardonable practice of leaving their thighs bare and exposed to cold, as is the almost universal custom; the carrying or wheeling of infants bare-headed in the cold; allowing children improperly clad to sit about in the open air in chilly weather, and to run about the house morning and night in their bare feet in cold weather, and similar practices that encourage the shocking of the skin by cold and disturbing the balance in the circulation of the blood are all prolific causes of croup.

Symptomatology.—The first thing that may be noticed is the hoarseness of the child's voice. Before any fever or subjective symptoms develop the parents may notice the sudden change in quality of the voice, but some indisposition may show for several days before the attack. Next, a slight cough appears that accentuates the coarse timbre of the voice. Its pitch sounds much lower than normal. Soon there are signs of fever and complaints of not feeling well. If the little one is old enough to describe sensations, headache may be spoken of.

The symptoms often develop with surprising suddenness. The child may appear well during the afternoon, and by 7 o'clock in the evening the voice changes to an unnatural hoarse quality, which may be overlooked by the untutored or careless until, two or three hours later, coughing and difficulty of breathing alarm them to the point of summoning medical assistance. With each inspiration now is heard the well-known crowing sound of croup. The temperature rises to about 103° F. as the night wears wearily on and the obstruction to respiration increases with the increasing false membrane. The true inflammatory character of the disease is apparent. The pulse is accelerated, bounding, and hard; the tongue coated; the skin hot and dry; the face red and puffed; and the secretions are checked. Unless relief is obtained by expulsion of some of the obstructing membrane the difficulty of breathing increases until the labor necessitated in aërating the lungs is pitiful in the extreme. The sound of the prolonged crowing inspiration and the lengthened expiration indicate the extreme narrowing of the chink between the vocal bands. As the blood becomes poisoned by the lack of oxygen the little one's face, flushed at first with a beauteous glow, takes on a bluish tinge that darkens as the world grows dark to the little sufferer, until, at last, a cyanotic hue announces the approach of death.

If portions of the false membrane are expelled, more or less relief is obtained, and a respite experienced until more membrane is formed to take its place, when dyspnœa again ensues. Often the worst is over in twenty-four or forty-eight hours, but in other cases the duration may be five or six days.

Diagnosis.—Membranous croup may be mistaken for laryngeal diphtheria, acute laryngitis, or laryngismus stridulus.

It may be difficult sometimes to distinguish croup from diphtheria. In croup the constitutional disturbance is less profound than in diphtheria. Obstruction to breathing is really the principal symptom of croup. Slight catarrhal symptoms and indisposition may exist for several days before the attack of croup, but the diphtheric attack is sudden and accompanied with severer symptoms. Croup is neither infectious nor contagious; diphtheria is both. In nearly every case of diphtheria there is a false membrane in the pharynx, but this is not true of croup. The difficult breathing of croup appears suddenly, while that of diphtheria is more gradual and lacks the spasm of croup. No other member of the family or community catches croup; diphtheria spreads to others, and has paralysis as a sequel, while croup has not. In case of doubt a bacteriological examination should be made.

Acute laryngitis resembles croup in some respects, but it is attended by more pain in the larynx, less difficulty in respiration, and by no formation of false membrane. Croup is a disease of childhood, while laryngitis is generally confined to later years. The peculiar crowing sound of croup does not occur in laryngitis. The cough of the two diseases differs, that of croup having a deeper hoarseness and not being so short and hacking as in laryngitis.

Laryngismus stridulus does not present the symptoms of sickness like croup. There is no fever and the labored respiration comes on quickly and subsides in a few minutes. The voice remains normal between the attacks.

Prognosis.—Membranous croup is a very fatal disease. Statistics show that considerably more than half of the cases die,—60 to 70 per cent. Since the introduction of intubation of the larynx by O'Dwyer the death-rate has very materially decreased. In a collective investigation made by Ranke concerning intubation in Germany he reports 1445 cases intubated for croup, with 553 recoveries, or 38 per cent.

O'Dwyer *(New York Medical Journal)* claimed that the "mortality of laryngeal diphtheria without treatment is 90 per cent., which can be reduced to from 27 to 47 per cent."

Attacks of great severity may progress rapidly to a fatal termination, the end being induced by a spasm of the glottis occurring in a few hours from the seizure. In others the larynx gradually fills with the false membrane, depriving the lungs of air until carbonic-acid poisoning, coma, and death occur.

Treatment.—A patient with croup should be kept in a moist atmosphere. I have made it a rule to put the child in a room containing a stove, when it is possible. Then, large vessels, like dish-pans or boilers, should be placed on the stove and just enough water poured in them to cover their bottoms and keep them from burning. Wet sheets are hung about the stove, a hot fire is kept up, and in this way the atmosphere of the room is maintained saturated with steam, and at a temperature of 76° or 80° F. If there is paper on the walls, it will, of course, be spoiled.

Unslaked lime is sent for, a bushel or more. A lump as large as a man's head is placed in a wooden bucket containing about two quarts of hot water. As chemical combination takes place an abundance of steam is generated which is conducted to the patient's head by a tent-shaped arrangement of a sheet.

In the first, or catarrhal, stage counter-irritation is useful over the larynx by means of mustard. An icebag (Fig. 194) may modify the intensity of the inflammation. Gottstein advises not only these, but the use of leeches on the upper part of the sternum.

Glasgow uses a spray of hydrozone thrown directly into the larynx. He believes the mechanical effect of the effervescence produced is to detach the false membrane and facilitate its expulsion. For the purpose of increasing the secretion of mucus, which has a similar effect, menthol crystals may be employed by fusing a few in a teaspoon over a flame until the air is comfortably impregnated with the fumes. Inhalations of vinegar are highly recommended by some writers.

Calomel, both internally and externally, has proved a valuable remedy. It is believed to be potent in preventing the formation of an exudate. It increases the secretions, which action in itself contributes to the casting off of the false membrane. J. Dundas Grant reports favorable results from 1-grain doses every four or six hours. With each dose he combines 3 to 5 drops of wine of ipecacuanha and 3 to 5 grains of bromide of potassium. I have for a long time been satisfied that calomel was efficacious, and have employed it in smaller doses more frequently administered, $^1/_2$ grain every two hours, until the bowels were considerably relaxed. I use the sodium bromide in preference to the potassium because it contains a larger percentage of bromine and is not so vitiating to the blood.

Fruitnight, in the *Archives of Pediatrics*, has called timely attention to the value of calomel fumigations in croup, whether looked upon as simple or specifically diphtheric. This treatment was originally suggested some years ago by Corbin, of Brooklyn, and later recommended by Dillon Brown. It should be used when there are symptoms of serious laryngeal involvement. "The amount of mercurial salt to be vaporized varies from 5 to 20 grains, repeated at intervals varying from one-half to two or three hours, according to the severity of the symptoms; in the average cases 15 grains hourly. The patient is to be kept in the vapor-saturated atmosphere, within a tent, for a period varying from ten minutes to one-half hour. In one hundred cases thus treated no case has been subject to deleterious results. In one case only did slight ptyalism occur. Salivation, diarrhœa, depression, prostration, and anæmia must be prevented by watchfulness and proper treatment." ("Year-book.")

Emetics play an important rôle in the urgent stage of croup. When the larynx is filling to the degree of threatening suffocation a prompt emesis will often loosen the false membrane and effect its expulsion. To accomplish this I have most often used turpeth mineral (yellow sulphate of mercury) and with the most gratifying results. One or two doses will produce vomiting in a few minutes and afford marked relief. Ipecac, alum, and sulphate of copper are efficient. I have never tried the last of these three. One should guard against the tendency of parents or nurses, or wise and more meddlesome neighbors, to overdose children with emetics, on account of the exhaustion and the irritability of the stomach which they produce. When these measures fail, intubation or tracheotomy must be done.

Children who are recovering from this disease have very sensitive throats and must be protected against cold air and draughts. They should be clothed throughout in woolen garments, and kept in-doors until a normal condition of the larynx is re-established. Sprays of cubebs, camphor-menthol, lavolin, pine-needle oil, oil of tar, etc., will assist materially in a complete restoration of the mucous membrane to a state of health.

CHAPTER XXIII.

DISEASES OF THE LARYNX *(Continued).*

Intubation of the Larynx.

To Joseph O'Dwyer, of New York, is due the credit of introducing the operation of intubation, which is now so commonly performed. Bouchut, of Paris, demonstrated in 1858 that the operation was practicable, but no practical results followed his discovery until O'Dwyer, without knowledge of Bouchut's work, showed actual recoveries due to it.

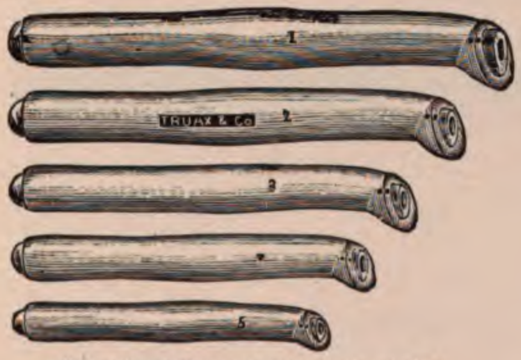


Fig. 93.—O'Dwyer's Intubation-tubes.

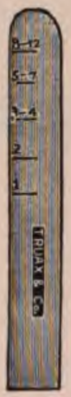


Fig. 94.—Scale.

The instruments for this procedure are a set of tubes of varying calibre, with a scale for measuring the tube, to assist in selecting the proper size; a mouth-gag (Fig. 72); an introducer; an extractor, and a protector for the surgeon's finger.

The tube (Fig. 93) is constructed with a flaring top that rests upon the ventricular bands. On one side of the flange is an aperture through which a loop of thread sixteen inches long is passed before introduction, in order that, if the tube accidentally passes into the œsophagus, instead of the larynx, it can be withdrawn. The obstruction of the tube with particles of membrane may also render it necessary to draw the tube out by the thread. It is safest to employ a strand of braided silk or linen thread, being certain that it contains no inequalities to catch in the fenestra.

The scale (Fig. 94) is used to determine the size of the tube to be employed, according to the age of the patient.

The introducer (Fig. 95) is screwed into the obturator of the tube, as shown in the illustration, and, when the tube is inserted into the larynx, pressure on the button of the introducer separates the obturator from the tube, leaving the latter in the larynx while the obturator is withdrawn.

The extractor (Fig. 96) is so constructed that, when the blades at the curved extremity are introduced into the mouth of the tube, pressure on the lever will separate the forcep-blades. These are roughened so that they obtain a grip that insures the extraction of the tube when they are withdrawn.

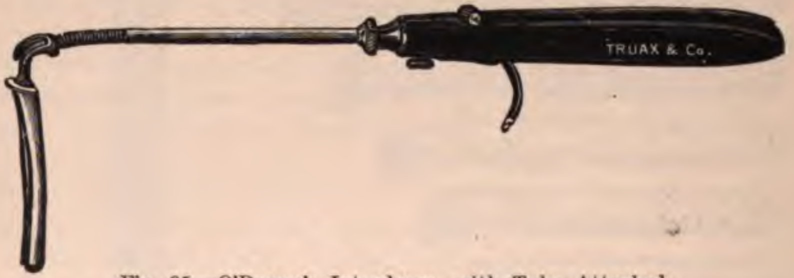


Fig. 95.—O'Dwyer's Introducer, with Tube Attached.

In addition to these instruments, one needs a protector against being bitten during the operation. J. E. Rhodes *(Journal of the American Medical Association)* reports that he has "devised a protector which consists of a rubber glove that covers the hand from the wrist to a little beyond the metacarpo-phalangeal joints. On the index finger the terminal phalanx only is left uncovered."

In order to prevent infection through the coughing of a patient while the operator occupies a position in front of his mouth, it is altogether safest to protect the eyes with glasses and the mouth and nose with a respirator or kerchief.

The operation is a very brief one, not extending over ten seconds. The quicker it is accomplished, the less it interferes with respiration, and, therefore, with aëration of the blood. One should acquire not only extreme dexterity, but gentleness, in order not to do unnecessary damage to the delicate structure encroached upon. With proper skill one should inflict no injury nor seriously interrupt breathing. In selecting the tubes it should be remembered that the smallest is intended for children younger than 2 years, the next size for those between 2 and 4, the third size for those between 4 and 6, the fourth for those from 6 to 8, and the largest for those over 8 years of age.

After the tube of proper size, according to the age of the child, as indicated on the scale, has been chosen, it is attached to the introducer by screwing the latter into the obturator contained within the tube, with the short side of the tube toward the handle, as shown. The tube is threaded as already described, and the instrument is laid within easy reach of the right hand. Now, the child should be placed upon the lap of the nurse or assistant and held as shown in Fig. 73, illustrating the operation for removing adenoid vegetations from the vault of the pharynx. The position assumed in the direct examination of the larynx, or autoscopy, would be a good one for intubation if it could be secured (Fig. 88). A strong sheet is wrapped and fastened about the child, so as to prevent any freedom of movement of its arms and legs, the latter being held between the nurse's knees. The nurse passes her left arm around the child's left side and over its arm, crosses the little one's wrists, and holds its right hand with her left and its left hand with her right, thus making it impossible for the child to interfere with the surgeon's work. One assistant places the mouth-gag, as shown in the figure referred to, with the gag resting between the molar teeth of the left side. He must attend assiduously to the holding of the gag in place and keeping the child's head, thrown a little backward on the nurse's shoulder, immovably fixed. If these directions are efficiently followed there can

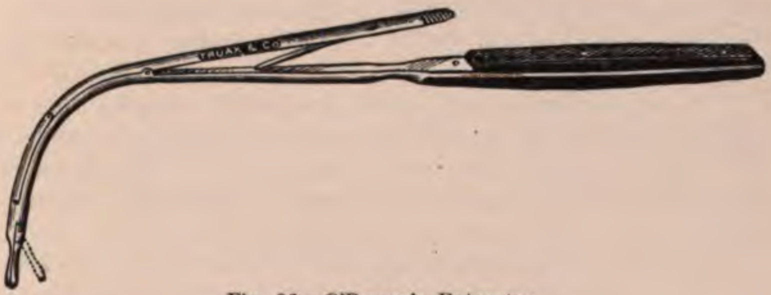


Fig. 96.—O'Dwyer's Extractor.

be no kicking, sliding down, snatching of the instrument, or dislocation of the gag.

The introducer, with tube and obturator attached and previously warmed, is then taken, the thread loop is passed over the left little finger, and the left index finger, being oiled, is carried into the pharynx until its tip rests behind the epiglottis and holds it upward. Now the end of the tube is made to follow the course taken by the tip of the inserted finger until it rests directly beneath it. The tip of the finger readily recognizes the epiglottis and the opening between the arytenoid cartilages. The instant the end of the tube rests beneath the tip of the finger in the median line, the handle of the introducer is brought upward so as to pass the tube from this point straight downward into the larynx. Unless this latter direction is followed at this particular step of the operation the tube will pass back of the larynx into the œsophagus. The tube once in the larynx, the thumb pushes the button and the tube is released, the introducer withdrawn, and the finger still in the throat presses the tube down into proper position.

The surgeon should not neglect the use of a finger-guard and some protector for his eyes, mouth, and nose during the introduction of the tube. A bite of the child or the ejection of a diphtheric discharge may cost the operator his life or communicate the disease to others.

Before introducing the tube it should be examined to see if the instrument works easily, if the tube is readily released, and if it will remain safely in position while it is being introduced. The larger the tube that can be used, the freer the respiration and the discharge of particles of membrane will be through it.

The thread is best not removed from the tube directly after the insertion, for an increase in the embarrassment of the respiration may occur, indicating that either false membrane has been pushed along below the tube to block up its lower opening or that the lumen of the tube is obstructed by the presence of false membrane or secretions in it. In either condition the tube must be removed forthwith. So the thread loop is secured by attaching another thread to it and passing it around the child's neck, and his hands must be kept away from it. As soon as it becomes apparent that the operation has fulfilled its purpose by affording freedom of breathing, the gag is reintroduced, the thread is cut, the finger-tip placed on the end of the tube to prevent its dislodgment, and the thread loop is withdrawn, leaving the tube in position. If the operation has been successful, the patient, relieved of the horror of impending suffocation, now drops into a peaceful slumber, which must be encouraged, in order that nature may recuperate its waning strength and fortify its resisting-powers.

Pellets of ice may now be allowed the patient to suck for quenching the thirst and to teach swallowing with the tube in place. Later a few drops of cold milk are given for the same purposes.

Should the first attempt to introduce the tube fail, the child must not be exhausted by too immediate an attempt for the second trial. A little rest is always best, unless the dyspnœa is exceedingly urgent. If the intubation fails or is followed by no relief, tracheotomy is the last resort. The physician should always be prepared for this emergency by having the tracheotomy instruments at hand.

A bottle of nitrate of amyl should be provided, for, in case of threatened collapse, the inhalation of a few drops of it may resuscitate the little patient.

For the removal of the tube the patient is prepared the same as for its introduction. The extractor is carried down, under the guidance of the tip of the protected left index finger, until it is slipped into the opening of the tube, when the lever is pressed upon by the thumb, the forcep-blades expanded to engage the tube, and the instrument is withdrawn with the tube attached. One must not forget to keep up the pressure that holds the tube attached to the extractor, or the tube might drop back into the throat. Removal of the tube may be necessary to clear it of obstructions or to ascertain when the patient no longer requires it. Should it be necessary to reintroduce it, a second tube had best be at hand already attached to the introducer, so that, if great dyspnœa occur before one has had time to clean and thread the tube removed, the other one can be inserted without delay. In case no other tube is at hand Northrup advises to "thrust the obturator into the tube and take two turns of thread of any kind around the neck of the tube, gathering the two ends in the right hand as it grasps the handle. In this way the thread holds the tube to the obturator during the insertion, and when it is in the larynx unwinds from the shaft and is drawn away."

After the tube has been in the larynx for a quarter of an hour, and there are no indications that it will have to be removed, the loop of thread is cut, and, with the finger in the pharynx and resting on the end of the tube the same as on its introduction, the string is withdrawn. Care must be taken not to disturb the tube in doing so. While the thread is in the mouth it excites nausea and retching.

The tube is allowed to remain in the larynx for several days, sometimes five or six, but, as soon as it becomes apparent that the disease has progressed so favorably as to render its presence there unnecessary, it is extracted. Sometimes it is coughed out.

In the course of three or four hours after intubation the larynx becomes accustomed to the presence of the tube; but if fluids are administered in a sitting posture they are almost certain to enter the larynx and excite violent coughing, which may expel the tube, or they may enter the lungs and cause pneumonia. The safest way to feed these patients is that proposed by Frank Cary, of Chicago, as follows: The patient is placed upon his back, with his feet elevated so that the axis of the body rests at an angle of forty-five degrees to the plane of the floor. The fluids are given through a tube or nursing-bottle in this position; then they do not gain entrance into the trachea. Solids do not enter the trachea. Custards, cornstarch, thick gruels, etc., are quite readily taken, and many children soon learn to eat and drink with the tube in position.

Intubation is to be preferred to tracheotomy in children under 5 years, particularly with an abundance of adipose tissue overlying the trachea. Parents more readily consent to this procedure than to an operation that involves the use of the knife. Intubation produces less shock than tracheotomy, and the air is better prepared for contact with the mucous membrane below the trachea after intubation than when it enters directly through the tracheotomy-tube. No anæsthesia is required for intubation, but it is generally necessary in tracheotomy, although I have operated without an anæsthetic in case of emergency. I have seen cases requiring tracheotomy in which the time necessary to produce anæsthesia could not be sacrificed, and, indeed, the carbonic-acid poisoning produced a sufficient anæsthesia.

There are instances in which intubation fails because the tube cannot be retained in position, or sufficient nourishment cannot be taken to support the waning strength, or the tube becomes so clogged that it has to be removed repeatedly. In these emergencies tracheotomy will have to be brought to our aid. Intubation is not difficult for the laryngologist, but one needs considerable practice in order to be reasonably sure of success. The best means of acquiring dexterity is to introduce a tube frequently into the larynx of a cadaver. In the absence of conveniences for this, the tube should be many times introduced and extracted by means of substituting a hand, preferably that of another, for the larynx. The tube should be placed completely out of sight in the hand while its aperture is sought for with the extractor. But it should not be forgotten that the passive hand differs somewhat from an obstreperous, struggling child. Intubation requires two assistants, and if possible, one of these should be able to remove the tube or to introduce it if it is necessary to remove it or if it is coughed up. So in case of intubation it is important that skilled assistants be at hand for these exigencies.

Tracheotomy is easier to perform, and can be done in extremities without skilled assistants. If the tube becomes clogged the nurse can prevent suffocation by removing it and maintaining the opening free until the surgeon arrives. In these respects tracheotomy presents advantages over intubation. In cities where skilled laryngologists are within easy calling distance intubation possesses superior merits. In the country, with all its unavoidable disadvantages, tracheotomy is hardly likely to be superseded.

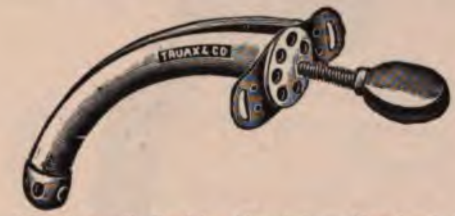


Fig. 97.—Roswell Park's Aluminium Tracheal Tube.

TRACHEOTOMY.

The instruments necessary for this operation are a small knife, double retractors (Fig. 205), hæmostatic forceps, tracheal forceps, a tenaculum, a grooved director, a flexible catheter, and tracheotomy-tubes of various sizes (Figs. 97 and 98). The average size, up to 3 years, is one-fourth inch (six millimetres). Other convenient articles should be at hand, if circumstances permit of their being supplied: sharp-pointed forceps, an aneurism-needle, thread, absorbent gauze, and tapes.

An anæsthetic should be given unless the requisite time would endanger life, or the diminution of the amount of oxygen reaching the lungs would add to a danger already imminent, or unless the sensibilities are sufficiently obtunded by carbonic-acid poisoning. In this operation chloroform is to be given the preference over ether, on account of the effect of ether in exciting glottic spasm and increasing the difficulty of respiration.

The high operation, in which the trachea is entered above the isthmus of the thyroid gland, is generally to be preferred to the low one, in which the incision is made below the isthmus, since in the high operation there are fewer and smaller blood-vessels to encounter (Plate V). Another advantage gained in the high operation lies in the more superficial position of the trachea.

The position of the patient during the operation is upon the back, with the head thrown backward by means of a narrow support under the back of the neck, to force upward prominently the anterior surface of the neck. If the operation is done without anæsthesia, the head, hands, and legs must be held by assistants.

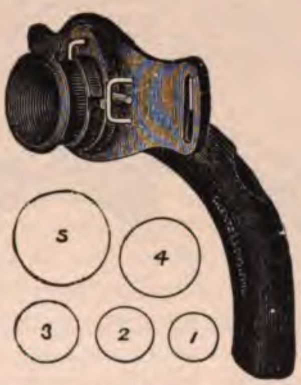


Fig. 98.—Hard-rubber Tracheal Tube.

The incision is made in the median line, over the cricoid cartilage, for the high operation, extending an inch or more above and below the cartilage. The superficial anterior jugular vein may be met with at this point, and requires to be drawn out of the way or doubly ligated and divided; but, if there is need for great haste, it can be secured by hæmostatic forceps until after the trachea is opened. The superficial fascia is opened, the grooved director inserted, and the incision is completed, after which the deep fascia is similarly incised. The knife-handle is used to separate the sternohyoid and the sternothyroid muscles; the self-retaining retractors (Fig. 205) are now inserted to keep the wound open and to check hæmorrhage by their pressure on its sides. The rings of the trachea can easily be felt, and the isthmus of the thyroid gland may protrude sufficiently to necessitate its being drawn out of the way. A transverse incision is now made, about one-half inch (one centimetre) long, over the superior border of the cricoid cartilage, penetrating the superficial layer of the deep cervical fascia. The grooved director is then introduced, passing from above downward between the cricoid cartilage and the deep layer of the deep cervical fascia. The two layers of fascia with the intervening veins and thyroid isthmus are drawn downward, exposing the upper rings of the trachea. These are fixed by the tenaculum and divided by an incision about one-half inch in length, according to the age of the patient. Great care must be taken that the knife does not penetrate the posterior wall of the trachea and the œsophagus. Equal forethought should insure that the false membrane is penetrated, so that the tracheal tube shall not be inserted between the membrane and the wall of the trachea, thus blocking up its opening. Care must be used to avoid the entrance of blood into the trachea and lungs. Coughing generally occurs when the trachea is opened, so that the secretions and portions of the false membrane are expelled. In case of diphtheria it is evident how necessary it is for the physician to be on the alert to dodge the bombardment of poisonous discharges.

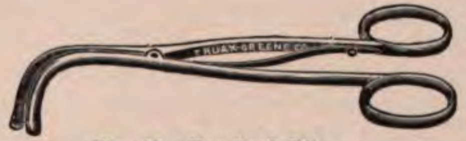


Fig. 99.—Tracheal Dilator.

The trachea being opened, a dilator (Fig. 99) is employed by many surgeons until the hæmorrhage ceases and free respiration is established. Sponging must be rapid; the opening must be maintained free from discharges; all false membrane within reach of the tracheal forceps must be extracted, and, finally, the tracheal tube is introduced and secured by tapes passing around the neck and tied on one side. As large a tube as the trachea will admit should be used. The patient must be closely watched and, if necessary, artificial respiration must be performed; clogging of the tube and interference with it must be prevented. All the tissues about the wound should be cleansed with a solution of bichloride of mercury, 1 to 5000, and a divided piece of gauze, smeared with carbolized vaselin, should be interposed between the collar of the tube and the surface of the wound.

The low operation is performed similarly to the one already described, except that the incision begins at the cricoid cartilage and ends about one-half inch above the sternum. The trachea lies deeper here; the blood-vessels are larger and more numerous and the thyroid isthmus is in the way. It is a more difficult procedure.

After tracheotomy the tube is best protected by a layer of bichloride gauze kept loosely above and about the tube, without impeding the currents of air. As rapidly as it is soiled this protector should be removed. The air of the apartment is kept at a uniform temperature of 76° to 80° F., and impregnated with moisture to prevent irritation of the mucous membrane of the deeper air-passages. During the first day the inner tube must be removed frequently for cleaning with a 5-per-cent. solution of carbolic acid, and to make certain that there is no obstruction. Sections of the false membrane may block up the lower end of the large, or outer, tube and require removing with the tracheal forceps. In such an emergency the cannula has to be removed. The nurse should always be instructed as to the possibility of such an accident, and that, should it occur, she must at once cut the tapes, remove the tube, cleanse and free the opening, and maintain its patency until the surgeon can be summoned. In two or three days the tube should be closed momentarily to determine if respiration is normal without it; if so, it can be dispensed with and the wound closed.

PLATE VI.

PLATE VI.

Figure 10.—Imperfect view of the larynx resulting from an improper inclination of the patient's head, or an incorrect position of the mirror. The head and mirror are not carried far enough backward.

Figure 11.—The conditions are similar to those mentioned in the description of Figure 10, but with some improvement, giving a partial view of the laryngeal cavity.

Figure 12.—Omega-shaped larynx of a child.

Figure 13.—Hyperæmia of the mucous membrane of the larynx, not involving the vocal cords or the epiglottis. The vocal cords are in the position of phonation.

Figure 14.—Congestion of the larynx involving the epiglottis, and the vocal cords to a slight degree.

Figure 15.—Acute laryngitis involving both vocal cords.

Figure 16.—Acute laryngitis involving the vocal cords and the epiglottis. The blood-vessels of the epiglottis are injected; there is an œdematous condition of the right half of the larynx.

Figure 17.—Chronic laryngitis involving the vocal cords, which are ulcerated near the posterior commissure.

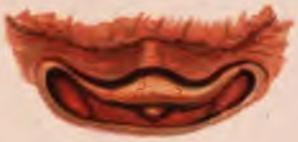
Figure 18.—Œdema of the larynx; phlegmonous inflammation.

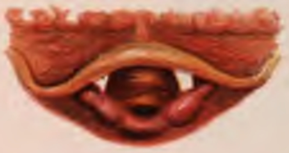
Figure 19.—Tubercular infiltration of the arytenoid cartilages, with superficial ulceration of the interarytenoid fold and the vocal cords.

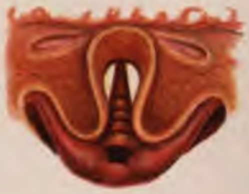
Figure 20.—Tubercular infiltration of the larynx. The epiglottis is pale and greatly thickened, together with the arytenoid cartilages, which are pear-shaped. The depressions between the cartilages of Wrisberg and Santorini are obliterated.

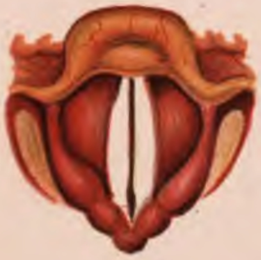
Figure 21.—Tuberculosis of the larynx; tumefaction of the arytenoid cartilages; ulceration of the vocal cords, the left ventricular band, and the interarytenoid membrane.

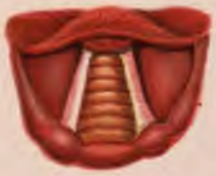
PLATE VI.

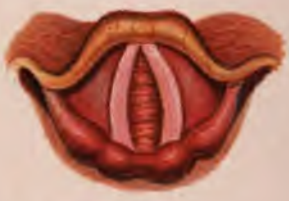

10

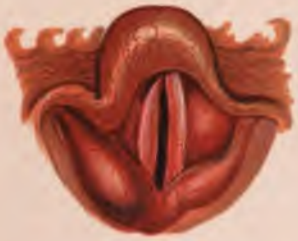

11

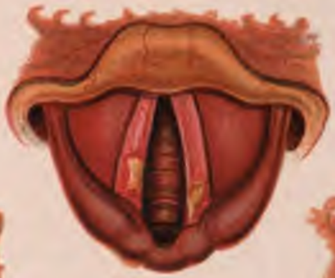

12

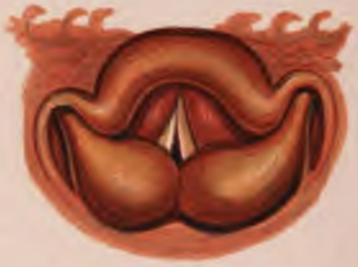

13


14

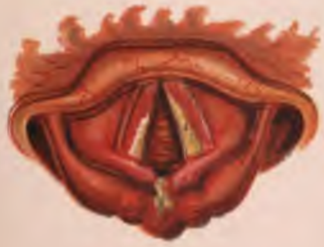

15

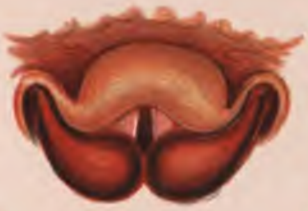

16


17

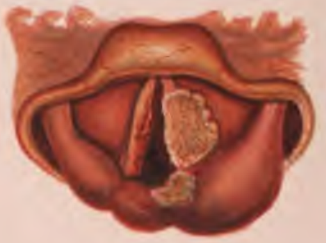

18

19




20

21



CHAPTER XXIV.

DISEASES OF THE LARYNX *(Continued).*

CHRONIC LARYNGITIS.

Synonym.—Chronic catarrh of the larynx.

Explanatory Note.—Before entering upon a consideration of this subject it is pertinent to explain why there is no separate article in this book, as is customary, on subacute inflammation of the larynx. There are many varying degrees of inflammation of the mucous membrane. During the same attack of acute inflammation the process exhibits different degrees of intensity, but the tendency of our times has been too much toward useless and confusing refinements and multiplication of pathological conditions into entities, when they were really but modifications of the same disease; like shades of the same color, there are variations of the same malady. Formerly the mild grade of acute inflammation of the middle ear was described separately as a subacute inflammation, although it is not a different disease; but the leading books on otology now discard this adventitious distinction, and laryngologists should lend encouragement to a sensible simplification of a terminology which is encumbered with unwarranted parasites of nomenclature. So we will not attempt to multiply the varying grades of intensity of an acute inflammation into separate diseases.

Pathology. — When acute laryngitis is neglected it naturally terminates in a chronic inflammation (Plate VI) which leaves the mucous membrane thickened and the small blood-vessels engorged and tortuous. There is an increase in connective-tissue formation, the encroachment of which on the epithelial layer produces the superficial erosions occurring in this disease. The posterior portion of the cavity only may be involved, or the inflammatory process may extend to every part of the larynx, not excepting the muscles. When the latter become indurated the mechanism of pitch-production is so interfered with as to render its changes very difficult. If the mucous membrane covering the vocal cords is thickened, the result is an alteration in the timbre or quality of the voice, which assumes a hoarse sound.

Etiology. — As chronic rhinitis is the direct result of repeated or neglected attacks of acute nasal catarrh, so chronic laryngitis may be a sequel of recurring or neglected attacks of acute catarrh of the larynx. But this disease is not always a heritage of an acute attack. It often arises spontaneously. Many patients who are afflicted with chronic hypertrophic rhinitis present a chronic laryngitis as a complication or result of the nasal hypertrophy. This is easily understood when we take into consideration the continuity of mucous membrane of the larynx, pharynx, and nasal cavities. In addition to this direct cause is another which illustrates the importance of prompt and efficient treatment of nasal anomalies. The discharges from the nose and naso-pharynx constantly find their way either directly into the larynx by dripping into the cavity, or they gravitate down to the immediate vicinity of the portal of the larynx, where they cause direct irritation by their presence, and indirect irritation by exciting efforts to dislodge them with a hacking cough. Bosworth lays stress upon this source of chronic laryngitis.

Another causative relation of hypertrophic rhinitis to this disease lies in the forced mouth-breathing in consequence of nasal stenosis. The air then reaches the larynx without the processes of purifying, warming, and moistening having been applied to it as they are by the nasal passages in a normal condition.

Excessive use of the voice, especially when it is taxed beyond its natural or acquired compass, sets up an hyperæmia and congestion that finally terminate in a chronic inflammation. Ambitious, but ill-trained singers, the periodical orators of political campaigns, hucksters, intensely emotional revivalists, etc., are frequent sufferers. Inactivity of the liver, and dyspepsia, alcoholic excesses, and atmospheric irritants are prolific producers of this disease. According to the observations of Ziemssen and Mulhall, boys are rendered susceptible to attacks of catarrhal laryngitis by the changes incident to the age of puberty.

Symptomatology.—The most marked symptoms are developed when attempts are made to use the voice. While it is at rest there may be very little to call the patient's attention to the fact that he has a larynx. In other instances there is a sensation of dryness or a slight irritation that excites a hemming or a little cough. But when the patient begins to call the vocal organs into activity the trouble begins. A tickling sensation is experienced that produces an irresistible desire to cough. Burning and pricking pains are felt in the larynx, which one endeavors to relieve by clearing the throat. In the midst of a sentence a cutting pain shoots through the organ, that may be described as a feeling as though the vocal cords were splitting or tearing. The sentence, or even the word, is cut short, and for an instant the speaker is unable to proceed until he clears the throat or takes a drink; hence arises the habit of many speakers of providing themselves with a glass or a pitcher of water before beginning a discourse.

The voice shows the most marked effect of this disease, but there are great variations in different patients, and peculiarities distinguishing certain cases. When a speaker, for example, begins an address, his voice may be husky and cracked in quality, while, after proceeding for a short time, the normal timbre may be restored. Singers experience the same peculiarity. This is probably due to the increased secretion stimulated by a quickened circulation, as well as to improved innervation resulting from the intensity of will-impulse. Another characteristic is the natural quality observed in the customary tones and the breaking of this quality on straining the voice, and even a condition of complete aphonia, or loss of voice.

The secretions are not copious in uncomplicated chronic laryngitis. They are generally tenacious and of a gray color, but if ulcerations are present they assume a yellow hue. As in the acute inflammation, there is rarely any blood in the expectorations, unless an unusually violent effort at coughing has ruptured the vessels.

Inspection with the laryngeal mirror shows an hyperæmic condition of the mucous membrane (Plate VI). As the figures illustrate, the small blood-vessels of the epiglottis are engorged and conspicuous. The vocal cords are sometimes red, one or both of them; at other times they do not participate in the inflammatory process. One cord may be affected, while the other remains of normal appearance, or parts only of the cords may show an injected condition of their blood-vessels. These parts are the lateral attached borders of the vocal bands. The condition of the membrane varies, according to the amount of secretions present, from absolute dryness to a general covering of the whole interior with secretions. Like similar conditions of the mucous membrane in other localities, a gradual thickening of the mucosa and submucous tissues results from inflammation of long duration, and the vocal cords may be affected by this hyperplasia to the extent of granulation formation, or trachoma. The presence of these excrescences materially embarrasses the vibration of the cords and changes the character of the notes produced.

The chronic thickening of the mucosa and the subjacent tissues diminishes the mobility of the larynx, just as we have seen that the increased thickness of the drumhead and of the tissues entering into the construction of the joints of the ossicles and the attachment of the stirrup to the oval window diminishes or destroys their mobility. For example of impeded movements due to hypertrophy: when the interarytenoid fold becomes thickened the arytenoid cartilages cannot approximate each other normally, which is equivalent to saying that the vocal bands cannot do the same thing. Great swelling of the ventricular bands obliterates the ventricles and deranges the actions of the vocal cords. One cord becomes paretic (Plate VII) and the opposite cord must do vicarious service, which it does by taking the place, almost literally, of its fellow, by moving across the median line to approximate its useless mate. The gap is then closed up, to a degree, and voice-production is made possible.

Ulcerations of a shallow kind are occasionally to be seen, generally in the interval between the arytenoid cartilages.

Diagnosis.—Chronic laryngitis is likely to be confounded with laryngeal œdema (Plate VI), paralysis, and cancer, or syphilitic and tubercular laryngitis. In œdema the swelling of the mucosa is out of all proportion to the thickening of chronic inflammation, and, although there may be redness, there is generally a pale, puffy, and water-soaked appearance, and the disease is of short duration. In paralysis neither swelling nor congestion is present. In the catarrhal condition hoarseness is generally more apparent in the morning hours, while the change in character of the voice in paralysis is constant, but less noticeable immediately after a night's rest. Paresis in the catarrhal condition more often affects one vocal band than both, according to Ziemssen; and the absence of mobility is much greater in paralysis. In catarrh the use of the voice often has the effect of clearing it of its cracked quality, while in paralysis fatigue and vocal exercise impair its quality.

Tubercular laryngitis presents a very different history from that of the simple catarrhal disease. The general condition of the patient and the presence of a tubercular condition of the lungs assist materially in making a differential diagnosis. The impaired nutrition and strength, the temperature and pulse, the night-sweats, and painful and difficult swallowing are characteristic of tuberculosis, but not of chronic laryngitis. The intralaryngeal pictures show certain differences in the two diseases. While redness is a symptom of catarrhal inflammation, the membrane in tuberculosis of the larynx may present a bloodless appearance, especially in the initiatory stage of the disease. Erosions, rare in simple catarrh, are characteristic of the tubercular affection. In laryngitis of the simple type, even when the erosions are found, they are superficial points of exfoliation of the epithelium; but in tuberculosis they may extend deeply into the membrane and be distributed over a wide area (Plate VI), affecting the epiglottis, the posterior commissure, the ventricular bands, and the vocal cords. The polypoid conformation of the arytenoid cartilages produced by the great thickening in advanced cases is well illustrated in the plate to which reference is made. This swelling extends to the aryepiglottic folds and appears dense instead of œdematous, although the paleness of the membrane may be suggestive of a case of œdema.

Syphilis of the larynx (Plate VII) may closely simulate a simple catarrh, but a syphilitic history or the presence of ulcers or their scars, and deformities due to the contraction of old cicatrices are valuable aids to diagnosis. The effects of the administration of specific remedies in experimental diagnosis are determinative in syphilis.

In both tuberculosis and syphilis of the larynx characteristic lesions in the pharynx may help greatly in arriving at a correct conclusion.

Chronic laryngitis may be with difficulty distinguished from a malignant disease, at first, but the histories of the two conditions vary. In the early stage of malignant disease the red, tumefied appearance is limited to a certain area instead of being diffused over a large surface. As the neoplasm increases in size it changes the contour of the parts as simple catarrh does not, and difficult and painful swallowing, together with loss of voice, are marked symptoms of malignant disease. As deep ulceration in the latter condition takes place the pain is more pronounced and continuous than is met with in simple chronic laryngitis.

Prognosis.—If the disease has not existed too long, and proper treatment and hygienic conditions can be had, the outlook is favorable. But if thickening of the tissues is great and extends to the laryngeal muscles, the difficulties to overcome are considerable. This trouble is usually protracted and extends over many years, in some cases, and, after treatment has accomplished all it will, the voice may still retain a coarse, unpleasant quality.

Treatment.—The topical application of remedies is easily accomplished with the improved apparatus of our day. Compressed air and sprays can be made to apply medicaments to the interior of the larynx with ease and efficiency. Useful devices are shown in Chapter I for both office and home treatment. Improved appliances for compressing air, both by hand and hydraulic power, are described in Chapter XXXI.

Various medicated sprays—as recommended by Lennox Browne, E. L. Shurly, Charles E. de M. Sajous, and others—will cleanse and disinfect the larynx, as well as produce astringent, sedative, stimulant, or tonic effects. It is claimed by Roe and Cohen that sprays thrown into the throat are largely condensed in the pharynx, but it can be easily demonstrated upon one's own larynx that the remedy can be made to medicate that organ also. If the spray is thrown through a long tube with a properly curved extremity (Figs. 9 and 10) for directing the current downward and a little forward from a position similar to that occupied by the laryngeal mirror *in situ*, the spray enters directly into the larynx. When the nebulizer is used with the lips closed over the mouth-tube and the patient inhaling through the instrument, the medicinal vapor not only reaches the laryngeal cavity, but the bronchi and lungs also. In former years I used the complete steam-atomizer of Codman & Shurtleff, but, as I could not discover compensating advantages of the steam method over the improved apparatus referred to, and as the latter requires far less time and trouble in giving treatments, I have for a considerable time preferred the instruments described.

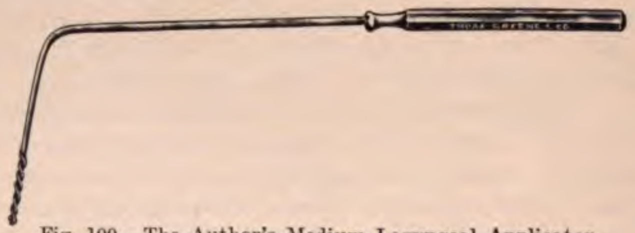


Fig. 100.—The Author's Medium Laryngeal Applicator.

For the application of pigments to the laryngeal membrane special camel's hair brushes, sponges, and cotton are used. I prefer the cotton, twisted firmly on short or long holders which afford a firm grasp (Figs. 100 and 101). The bristles of the brush sometimes become detached and stick in the larynx, like the voice of Æneas. This is not amusing to the patient. Applicators for caustics are specially constructed, but, with a minute cotton-tip twisted very firmly on a carrier, escharotics can be conveniently applied.

Counter-irritants, like mustard and tincture of iodine, are sometimes serviceable. They should be applied to the skin directly over the larynx and at its sides. It is exceedingly important that the cause of the trouble be removed, and this will generally be found to lie in inordinate and improper exertion of the voice. In such cases absolute rest must be enjoined. When the cough is very troublesome the compound spirit of chloroform or Hoffmann's anodyne will relieve the irritation. The inhalation of camphor-menthol from the pocket-inhaler (Fig. 23) allays the tickling sensation.

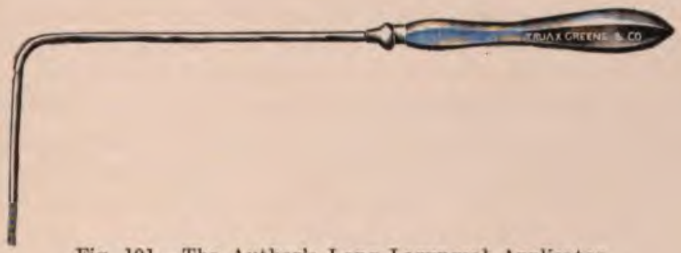


Fig. 101.—The Author's Long Laryngeal Applicator.

When the thickening of the membrane is considerable, sprays of eucalyptol, 4 per cent.; camphor-menthol, 3 per cent.; or oil of cubebs, 4 per cent., in lavolin should be used once or twice a day. Alum, in a 2-per-cent. solution; zinc sulphate, 1 per cent.; or silver nitrate may be used according to the indications in each case. When much irritability exists, with a hacking cough and copious secretions and expectoration, inhalations of a 10-per-cent. solution of camphor-menthol in lavolin are effective. These should be taken through the nebulizer, and not in the form of a coarse spray.

In cases of hoarseness and failure of the voice in public singers and speakers I have obtained most gratifying results from zinc chloride, 10 or 20 grains to the ounce of water, and cupric sulphate, 15 grains to the ounce, applied by means of the cotton applicator. Inhalations of a vapor consisting of camphor-menthol, 10 per cent.;

oil of cubebs, 50 per cent.; and benzoinol, 40 per cent., have aided materially in restoring the voice.

If erosions are discovered, hydrozone, diluted one-half with warm water, at first, should be sprayed upon the ulcers; then aristol should be sprinkled over them. Iodoform is preferred by some, tannin and alum by others. Chromic acid, 5 or 10 grains to the ounce, and silver nitrate have able advocates.

Atrophic Laryngitis.

For the pathology of atrophic conditions of the mucous membrane, see "Atrophic Rhinitis."

This requires stimulating applications. The lavolin-sprays containing the remedies already given are useful,—viz., eucalyptol, oil of cubebs, benzoinated lavolin, menthol, terebene, salol, oil of tar, etc. Shurly recommends iodine in the form of syrup of hydriodic acid, in drachm doses, three times a day, or iodide of potassium or ammonium. Much relief is afforded by my ammonium-chloride tablets, the formula of which will be found on page 151. Two or three can be used in the course of an hour, being allowed to dissolve slowly in the mouth, so that the medicated saliva will trickle down and remain in contact with the mucous membrane about the entrance to the larynx as long as possible.

Suppurative Laryngitis.

Synonyms.—Phlegmonous laryngitis; purulent laryngitis; diffuse abscess of the larynx.

Pathology.—This is an inflammation of the submucous tissues of the larynx (Plate VI), with infiltration of the areolar tissue and suppuration, ending in the formation of abscesses. The area most frequently involved is the superior part of the larynx, contiguous to the epiglottis.

Etiology.—Suppurative inflammation of the larynx may be idiopathic, or it may arise secondarily by extension from the pharynx. It may originate in a perichondritis which is secondary to syphilitic infection or other wasting disease.

Symptomatology.—Difficult respiration and impairment or suppression of the voice are the most prominent symptoms. There is a choking or stifling sensation, as though a foreign substance had gained entrance into the larynx, accompanied by increasing pains. Some difficulty in deglutition appears; all the symptoms become exaggerated; the breathing is strident, the voice feeble and cracked, the face puffed and purple, and suffocation seems imminent. Frequent attempts are made to free the throat by hemming rather than by coughing. Laryngoscopy reveals the inflamed, tumefied mucous membrane obstructing the air-current. Circumscribed swelling may be seen in the region of the aryteno-epiglottic folds, and other parts of the larynx may become œdematous.

Diagnosis.—Inspection discloses the differences between this disease and the presence of foreign bodies, diphtheria, croup, tumors, pharyngeal abscess, and spasmodic croup. The dyspnœa of this disease appears more gradually than that occasioned by the presence of foreign bodies or laryngismus stridulus, in which the obstruction to breathing occurs suddenly. The history of a tumor does not present the characteristics of an inflammation.

Prognosis.—Suppurative laryngitis is a rapidly fatal disease. It kills about three out of four of its victims. Death is caused by strangulation or inanition.

Treatment.—If the patient is seen at the onset of the attack, cold, in the form of icebags (Fig. 194), should be constantly applied over the larynx. Pellets of ice may be sucked so as to produce the effect of cold internally as well as externally. Leeches may be applied over the upper portion of the sternum, but in this disease there is one objection to them that may not have weight in other diseases of the larynx,—*i.e.*, the patient soon becomes exhausted from the lack of nourishment, owing to the impossibility of swallowing sufficient food, and bleeding only adds to his weakness. The air should be kept moist, the same as in croup. Œdematous tissue and abscesses must be evacuated by scarification. Supportive and stimulant treatment must be combined with nutritious enemata to meet the inevitable failure of strength. Suffocation must be prevented by tracheotomy or intubation.

Abscess of the Larynx.

The physical conditions in this disease coincide so closely with those just described under the heading of "Suppurative Laryngitis," in which abscesses occur, that a separate description would be tantamount to tautology. The treatment is the same as for abscesses occurring in suppurative laryngitis.

TRACHOMA OF THE VOCAL CHORDS.

As a result of chronic laryngitis of long duration, a roughened condition of the vocal bands is found, to which the name "chorditis tuberosa," or granulations, is sometimes applied. There is a proliferation of connective tissue, productive of inequalities that are apparent in the laryngoscopic image. This condition obtains most frequently in public speakers and singers and is sometimes quite intractable to treatment. F. I. Knight claims that the granulations may disappear without treatment.

Treatment.—The remedies recommended for chronic laryngitis are applicable here. Charles E. de M. Sajous advises applying chromic acid to the cocainized hypertrophies. This is best accomplished by fusing the acid on a protected applicator, bent to the proper curve. Only a few of the prominent points should be touched at each treatment. Silver nitrate is preferred by Rice and Cohen, and the curette by Heryng. The biting curette (Fig. 102) or the electrocautery (Fig. 108) may be adapted to certain cases. The writer prefers the electrocautery, but has employed the chromic-acid and silver-nitrate beads with satisfactory results.

ŒDEMA OF THE LARYNX.

Synonyms.—Œdematous laryngitis; purulent laryngitis; œdema glottidis.

Pathology.—The loose attachment of the mucous membrane to the walls of the larynx favors infiltration and separation of the mucosa from the cartilages (Plate VI). The changes that take place in acute œdematous inflammation occur so rapidly as to preclude their study, the disease proving rapidly fatal in many cases. In this form the infiltration consists of serum, but in the more protracted attacks it consists of a mixture of serum and pus, with effusion of blood in occasional instances. The epiglottis is sometimes involved to the extent of becoming greatly enlarged. The loose areolar tissue of the aryepiglottic folds is probably more copiously engorged with the fluid exudate than any other portion of the larynx, and the ventricular bands suffer nearly as much. The true vocal bands may escape altogether or participate to the degree of slight swelling. The laryngeal muscles may present a water-soaked appearance, if a post-mortem examination is made, after death due to this disease. Associated with œdema of the larynx may be a similar infiltration of the pharynx and even of the neck.

Etiology.—Most cases of laryngeal œdema occur between the ages of 20 and 35 years, and are nearly three times as frequent in men as in women. It may be idiopathic or symptomatic. Nearly three times as many cases are secondary as are primary in character,—that is, most cases are consecutive to some other affection, such as Bright's disease, that gives rise to a dropsical condition of lax tissues. When œdema of the pharynx invades the adjacent laryngeal tissues, the latter is termed contiguous œdema; and when laryngeal œdema is secondary to some other disease of the larynx it is designated as consecutive. Any cause that operates to produce inflammation of the laryngeal mucosa or submucosa may be a cause of œdema. Exposure to cold or impure air containing irritating particles or gases, injuries, scalds, corroding chemicals, and certain diseases, such as Bright's disease, syphilis, tuberculosis, and typhoid and the eruptive fevers cause or predispose to this disease.

Symptomatology.—The prominent and most distressing symptom is the difficulty of respiration. There is a sensation as if a foreign body had gained entrance into the throat, and difficulty of swallowing adds to the suffering. As the swelling and consequent stenosis of the larynx progresses, the labor of breathing becomes more arduous, until the patient is threatened with impending suffocation. As the lumen of the larynx is encroached upon, and the pressure of the tumefied tissues increases, the voice becomes feeble and finally disappears.

Frequent efforts are made to clear the throat of the obstruction, but they are not of the character of a cough. There is but little expectoration, and this consists of mucus. The suffering occasioned by this disease is intense, not only of the patient, but of his helpless friends. He cannot lie down, but sits with his body and head thrown forward, unable to speak, but exerting every muscle to draw in enough air to support life. He calls to the bystanders for help, has them support his arms and shoulders, one attendant on either side, while he seeks the open window for air. The noise of inspiration is harsh and indicative of the extreme narrowing of the glottis. Moments of relaxation and relief may occur, only to be followed by the paroxysm that threatens immediate suffocation. As the sufferer gasps for air, with open mouth and horror-stricken eyes, his face puffed and purple, his whole frame convulsed with an agonizing struggle for life, the surgeon or death soon comes to his relief and closes the scene.

Inspection, when it is possible, reveals the epiglottis red and swollen to enormous proportions, and it may cut off a view of the laryngeal cavity. The enlargement becomes so excessive as to amount to a deformity. The aryepiglottic folds are seen to be tumefied even to the point of medial contact with each other over the laryngeal opening during inspiration.

When inspection is impossible, a quick, but gentle, palpation with the finger, not interrupting respiration to a dangerous degree, may enlighten the examiner as to the condition present. The roll-like character of the epiglottis and the spongy feeling of the aryepiglottic folds are characteristic.

Diagnosis.—Œdema of the larynx may be mistaken for the presence of a foreign body, polypus, retropharyngeal abscess (Platé IV), acute laryngitis (Plate VI), or pulmonary emphysema. The symptoms and the conditions presented on examination are sufficient to mark the differences. Diphtheria of the larynx can be detected by the discharge of shreds of the false membrane, and the latter is generally found in the pharynx also.

Prognosis.—About one-half of all cases of this disease terminate fatally. Acute laryngeal œdema has an average duration of about a week. Cases arising in the course of pharyngeal œdema generally pursue a favorable course, but those resulting from aneurism of the aorta or of other important vessels of the neck prove fatal. The same is true of œdema arising from an extension of the disease from the external areolar tissue. Tubercular œdema is unfavorable, but the syphilitic type is amenable to treatment. The prognosis should always be guarded.

Treatment.—Scarification is the classic remedy, but there are other means of relief that have come into use in later years. Pilocarpine depletes the blood-vessels of their serum and is indicated here to drain the water-soaked tissues. It can be given in doses of $^{1}/_{8}$ or $^{1}/_{16}$ grain until free salivation and diaphoresis are produced. Enough to cause heart-depression should not be administered.

In violent acute cases the blanching, shrinking, and anæsthetic effects of cocaine would appear to be indicated. I have never tried it in this condition, nor have I seen it mentioned in this connection, but for prompt action and immediate relief from impending suffocation its physiological action suggests its use. The action of suprarenal extract in contracting the blood-vessels and shrinking the tissues promises well. Unless a speedy change for the better takes place, scarification, intubation, or tracheotomy should be done.

When œdema has become chronic, its treatment is much like that of chronic laryngitis, with the addition of scarification. Dilatation by Schrötter's method with hard-rubber tubes has proved useful, and the intubation-tubes promise good results. In severe cases tracheotomy may become imperative.

CHAPTER XXV.

DISEASES OF THE LARYNX *(Continued).*

NEUROSES.

SPASMODIC CROUP.

Synonyms.—Spasm of the larynx; spasm of the glottis; laryngismus stridulus.

Pathology.—According to Marshall Hall, this is a reflex nervous disease the exciting cause of which may be located in remote organs, —for example, in the teeth, the intestinal tract, or at a point of pressure on the recurrent laryngeal nerve. It is believed by some authorities to be of purely cerebral origin.

Etiology.—This is, for the most part, a disease of childhood, although it occasionally occurs in adult life. It may be brought on by the accidental entrance of liquid or food or any foreign body into the larynx. Dentition is a common cause, and mental emotion may give rise to attacks.

Symptomatology.—The closure of the glottis may be complete or incomplete. In the former case there is entire arrest of respiration temporarily. The child is taken with a sudden convulsion; the eyes are rolled; the hands and feet are cramped, and even opisthotonos may supervene. All at once a spasmodic inspiratory movement occurs, announcing the cessation of the spasm. When the glottis is incompletely closed, the air passes through it with a harsh, croupy sound, which resembles closely a crowing of croup or the whoop of whooping-cough. During these distressing attacks the face becomes flushed, congested, or livid, according to the severity of the attack, and the veins of the neck are distended. In extreme cases the spasm does not relax and the child dies in convulsions.

These attacks may follow each other rapidly, or one only may occur at long intervals, and the child appears in excellent health between the attacks. They occur usually at night, waking the child out of a sound sleep. They are not accompanied by fever or cough, but there is copious perspiration. Children under 2 years of age are most frequently subject to this disease, and boys are attacked more often than girls. Those whose systems are impoverished are the most likely to suffer. In this respect spasmodic croup differs from true croup.

Diagnosis.—Spasmodic croup does not closely resemble any other disease except true croup, from which it can be differentiated by the absence of fever and false membrane and by the presence of good health as soon as the transitory paroxysm yields and normal respiration succeeds.

Prognosis.—When the attacks do not show a high degree of intensity of the spasmodic contraction, and when they do not last long or do not occur at short intervals, the prognosis is usually favorable. But when the closure of the glottis is complete the child may die of strangulation before help can be summoned. The more frequently the paroxysms occur, the more danger there is to life. If the spasms are due to cerebral disease the prognosis is grave.

Treatment.—For immediate relief a few drops of amyl-nitrite, ethyl-bromide, chloroform, or ether may be inhaled, if any air is inspired. If not, dashing cold water in the face, slapping the back of the shoulders, applying ice to the back of the neck, tickling the throat, or introducing the finger to cause vomiting may succeed in aborting the attack. While the finger is in the throat it should be used to learn whether the epiglottis is impacted in the aperture of the larynx, and, if it is, the tip of the finger should be hooked under the epiglottis and made to raise it into position. Drawing the tongue out of the mouth also raises the epiglottis. A hot mustard bath may relax the spasm. Hypodermic injections of apomorphine, in very minute doses, or a dose of turpeth mineral, 1 or 2 grains, may excite vomiting and end the paroxysm. Powdered alum in teaspoonful doses is a harmless and efficient emetic.

The cause of the attacks must be ascertained and prophylactic measures adopted. Laryngitis, indigestion, troublesome teeth, or irritation of the genital organs, especially of the prepuce, may bear a causative relation to this disease. As a rule, general tonics, nervous sedatives, and an especially nutritious diet are indicated.

ANOMALIES OF SENSATION.

Hyperæsthesia, neuralgia, and paræsthesia of the larynx are most commonly met with in singers and public speakers who strain their vocal organs.

Pathology.—Congestion of the laryngeal mucous membrane is often present, but inspection may not reveal any apparent structural change; this is true when the affection is purely neurotic.

Etiology.—Excessive use of the voice after faulty methods, over-indulgence in alcoholic beverages, excessive smoking, varicose veins and hypertrophied glands at the base of the tongue and inflammatory affections of the larynx occasion hyperæsthesia. The causes of paræsthesia are quite numerous and sometimes obscure. Anything that produces a depressed condition of the nervous system may be said to predispose to this nervous anomaly. Foreign bodies in the larynx and inflammatory conditions of the mucous membrane cause it. To these causes, and to the uric-acid diathesis, neuralgia is due.

Symptomatology.—The laryngeal mucous membrane is often exquisitely sensitive in hyperæsthesia, so that dusty or cold air, the fumes of a match, smoke, etc., provoke fits of coughing. There is usually a sensation of dryness, or scratching, or tickling in the larynx that excites hemming or slight coughing to give relief. Neuralgia here, as elsewhere, is not constant. Fugitive pains and sensations of soreness of a transitory nature are present. In paræsthesia there are unusual sensations, generally of a foreign body in the larynx. Patients sometimes can scarcely be convinced that the impression is not produced by a foreign substance. This is called globus hystericus.

Diagnosis.—There is not much difficulty in deciding upon the nervous nature of these affections, since examination generally fails to discover any physical signs. The symptoms are quite characteristic.

Prognosis.—These troubles are rather annoying than serious. They are persistent, but amenable to treatment.

Treatment.—If any irritation is found, the throat-tablets—containing ammonium chloride, 1 grain; camphorated tincture of opium, compound syrup of squills, and syrup of Tolu, each 5 minims; and extract of licorice, 3 grains—may allay the irritation and cough. Inhalations of oil of cubebs, carbolic acid, salol, and eucalyptus in lavolin, as described under the healing of "Sprays and Inhalents," are beneficial. When hypertrophied glands and varicose veins are found in the pharynx, and especially about the base of the tongue, they are to be eradicated by means of the cautery. The bromides and other nervous sedatives and nervous stimulants, like valerianate of ammonia, are demanded in certain cases. General tonic treatment is often necessary, combined with a fattening regimen.

W. Peyre Porcher emphasizes the fact that the lithic-acid diathesis may stand in a causative relation to these neuroses, and that such cases must receive antirheumatic treatment, including colchicum, salol, guaiac, the salicylates, etc.

NERVOUS APHONIA.

Synonyms.—Hysterical aphonia; hysterical paralysis of the vocal cords; functional aphonia.

Pathology.—This is a functional bilateral paresis of the lateral cricoarytenoid muscles, interfering with the normal relations of the vocal cords during attempted phonation. They cannot be properly approximated. It is not due to any organic lesion, but to a temporary loss of the power of muscular co-ordination or of innervation.

Etiology.—This affection is a symptom of hysteria and debilitating diseases. It occurs most frequently in unmarried women, and is especially marked between puberty and the establishment of the menopause.

Symptomatology.—A peculiarity of this disease is that the patient may not be able to utter the common conversational tone, but may cough or laugh audibly, which does not occur in complete paralysis. The onset is sudden, like that of spasmodic croup, and the patient cannot attribute it to any cause; or it may follow upon an intense mental impression. Even whispering is sometimes out of the question. The attacks are irregular, appearing one day and disappearing the next, without any premonitory signs or symptoms. The impression of cold often develops the symptoms, and this fact may account for patients, exposed to draughts of air at night, losing their voices between the hours of retiring and arising.

Inspection during phonation shows the effect of the loss of power of the adductors. The vocal cords cannot be brought into close relationship. Efforts to approximate them may cause a spasmodic approaching of the cords, followed immediately by their wide separation. Unless a catarrhal condition exists, the larynx is pale and presents no inflammatory appearances.

Diagnosis.—The history, symptoms, and appearances described render the diagnosis easy.

Prognosis. — This is favorable, although there is a liability of the attacks to return. This is the kind of trouble in which the various sorts of "mind-cures" are effective. The mental impression made by simply introducing any indifferent instrument, such as a laryngeal mirror, into the throat may restore the voice. In other cases actual treatment must be pursued for a considerable time to effect a cure.

Treatment.—Strychnine, beginning with $^1/_{30}$ grain and increased gradually until its physiological effects are produced, and electricity are efficient remedies. Sir Morell Mackenzie devised a laryngeal electrode for this purpose, by means of which one electrode is applied within and the other without the larynx. The galvano-faradic current is preferable. If the muscles have not become atrophied this treatment is speedily beneficial.

The elixir of the valerianate of ammonia, combined with quinine, if a tonic effect is desired in addition to that of a diffusive nervous stimulant, meets the indication admirably. Zinc valerianate in 1-grain doses every four hours is recommended by Sajous, as well as coca-wine.

REFLEX AFFECTIONS OF THE VOICE.

The condition of the vocal cords is affected by certain states of the generative organs. Singularly enough, the same causes seem to produce opposite effects in different subjects. The author has observed that in some soprano singers the occurrence of the menses is accompanied by a huskiness, or roughness of timbre, of the voice; but in others the same periods are characterized by a clearer, fuller, and more flute-like quality of tone. However, the latter effect is probably exceptional. Uterine and ovarian diseases have a deleterious effect on the voice, especially noticeable in the singing voice, and any treatment to restore the voice-deterioration must include gynæcological measures. C. H. Leonard has reported cases in which voices impaired by uterine disease have been restored, and in one case two full notes were said to have been added to the upper register of a high mezzosoprano as a result of uterine treatment. In the latter case there were anteflexion, narrowing of the uterine canal, and endometritis.

These facts are not surprising when we consider the close sympathetic relations existing between the uterus and the central nervous system. Bischoff has shown that division of the spinal accessory nerve, or of the inferior laryngeal, causes aphonia. The close relationship of the nervous supply of the sexual organs in the male to the innervation of the larynx is aptly illustrated in the unnatural voices of the castrated male sopranos. The voices of hermaphrodites, also, are anomalous.

LARYNGEAL PARALYSIS.

The laryngeal muscles may be paralyzed singly or in pairs, or several muscles may be affected simultaneously. The paralysis may be unilateral (Plate VII) or bilateral, affecting only one side or both. Anæsthesia of the laryngeal mucous membrane may exist as a complication. The paralysis may be of central origin, the disease being located in that part of the brain in which the laryngeal nerves have their origin, or it may be due to a disease in the course of the nerve-trunk. On the other hand, the lesion may be of a local character, the muscles being affected either primarily or secondarily to some debilitating systemic malady.

Pathology.—Cerebral causes of paralysis of the laryngeal muscles are: the gummata of syphilis, apoplexy, multiple sclerosis, tumors, etc. Diphtheria is one of the most frequent causes, aneurisms and tumors in the neck, progressive bulbar paralysis, hypertrophied glands, etc., are among the causes. The recurrent laryngeal nerve is subject to pressure from aneurism of the arch of the aorta, the left carotid, or the subclavian artery. Aneurism of the carotid, the subclavian, or the innominate artery on the right side may produce the same effect. These conditions result in unilateral paralysis, in which the epiglottis cannot be completely closed and there is loss of power to extend the vocal cord. When an aneurism or other tumor is large enough to occasion pressure on both recurrent laryngeal nerves bilateral paralysis results.

The laryngeal muscles may become the seat of disease which, independently of any affection of the nerves, may impair or destroy their function. An extension of the inflammatory action from the mucous surfaces to the muscular tissue, with exudation and swelling, may produce a paretic condition of a transitory nature. Degenerative changes, such as atrophy of the muscular tissues, may occur to such an extent as to eventuate in muscular paralysis.

Etiology.—Certain drugs and chemicals cause laryngeal motor paralysis, such as the following: Belladonna, opium, phosphorus, arsenic, mercury, lead, and alcohol. Such diseases as diphtheria, rheumatism, syphilis, anæmia, and inflammation of the adjacent areolar tissue and glands are causative conditions.

When paralysis of the muscles of abduction — the posterior cricoarytenoid—occurs, the vocal cords lie in such constantly close relation to each other as to present a serious obstruction to respiration. The breathing is noisy and labored, and suffocation is imminent. The voice is not affected because of the action of the arytenoideus muscle in approximating the vocal bands. When unilateral paralysis of the posterior cricoarytenoid muscle takes place there is no dyspnœa except on great exertion (Plate VII). When both sides are affected it may be due to brain disease in the region of the fourth ventricle or in the medulla affecting the pneumogastric and spinal accessory nerves.

Paralysis of the muscles of adduction—the lateral cricoarytenoid—results in the vocal cords remaining in a condition of abduction, or separation from each other as far as possible. This occurs most frequently in hysteria and leaves no vestige of the voice. If this paralysis is unilateral, whispering may be possible.

When paralysis of the arytenoideus muscle happens the voice is very feeble or altogether lost. A triangular space between the vocal cords, behind the vocal processes, remains during phonation in consequence of the loss of contractility of this muscle.

Paralysis of the muscles of tension—the thyrocricoid and the thyro-arytenoid muscles—is not infrequent. Paralysis of the thyrocricoid muscles leaves the vocal cords relaxed and uneven. They may be seen in contact with each other at irregular intervals and moving unnaturally,—depressed and elevated in the currents of air. The timbre of the voice is changed to a hoarse, monotonous quality. The respiration may be more or less embarrassed. Paralysis of the thyro-arytenoid muscles prevents approximation of the vocal bands, especially at their centres, so that an elliptical aperture remains between them. The voice is feeble, easily wearied, high-pitched, and husky. Inordinate use of the voice is the most frequent cause of this form of paralysis.

All three forms of paralysis already described sometimes co-exist,—paralysis of abduction, adduction, and relaxation. This condition results in total suppression of the voice. The vocal bands remain passively half-way between abduction and adduction, or in the cadaveric position. The usual causes are aneurism of the arch of the aorta, goitre, or disease of the œsophagus. If a brain disease were the cause, there would be loss of sensation and an erect epiglottis, indicative of paralysis of the superior laryngeal nerve. There may be unilateral paralysis of abduction, adduction, and relaxation, in which case but one vocal band assumes the cadaveric position (Plate VII). In this form of paralysis the opposite and unaffected vocal cord may perform vicarious function, so that the voice is but little roughened in quality; but, unless the power exists to draw the healthy cord beyond the median line to approximate its paralyzed fellow, the voice is seriously affected or destroyed. The effort of speaking soon tires the patient, and exertion causes labored respiration.

Treatment.—The wide variation in the nature of the causes of laryngeal paralysis renders it impracticable, in a work of such an elementary character as this, to deal in detail with all of them. Lesions of the nervous centres, of the circulatory system, of the apex of the lungs (especially of the right, a disease of which may cause pressure on the recurrent laryngeal nerve), enlargement of the glands of the neck, inflammation of the surrounding tissues and of the laryngeal mucous membrane, tumors, and rheumatic and syphilitic conditions call for treatment adapted to each disease. Drug and chemical poisoning must be met with antidotes, restorative measures, and removal of the cause.

Strychnia, internally and hypodermically, to the degree of producing its physiological effects, is valuable. The faradic current, applied to the interior and exterior of the larynx by the special laryngeal electrode, is efficacious. If the mucous membrane of the larynx is sensitive it may have to be cocainized to admit of the application of the negative pole to the interior of the cavity. The current is applied by means of the kid-covered electrode, the tip of which must be moistened. By the aid of the laryngeal mirror this electrode is carried to the points that require the current, while the positive pole is applied to the front or sides of the exterior of the larynx. Compound electrodes are made so that both poles may be applied within the larynx. Their use is attended with more difficulty than presents in the introduction of the single electrode. The current is turned on for a few seconds at a time, and repeated frequently during a treatment, which is given on alternate days. General tonic treatment and appropriate hygienic measures must be employed, according to the necessities of each case.

CHAPTER XXVI.

DISEASES OF THE LARYNX *(Continued)*.

TUBERCULOSIS OF THE LARYNX.

THIS is one of the most common of laryngeal affections and generally proves fatal. It is seldom a primary disease, but usually is associated with the same condition in other organs, and in such cases is a secondary affection. About 25 or 30 per cent. of cases of pulmonary tuberculosis exhibit laryngeal invasion.

Pathology. — The pathogenic principle of tuberculosis consists in a micro-organism,—the tubercle bacillus,—which gains entrance into the laryngeal tissues by becoming ingrafted upon an area of mucous membrane denuded of its epithelium. Within a few weeks after the development of primary laryngeal tuberculosis the lungs are invaded by the infection; so that we witness an intimate reciprocal relation between the various sections of the air-passages: laryngeal tuberculosis is very often a sequel of pulmonary tuberculosis, and consumption of the lungs may develop as a secondary manifestation of tubercular infection of the larynx.

Generally the first changes observable in the larynx are: an unnatural paleness and tumefaction of the epiglottis (Plate VI), succeeded by a superficial, ragged-edged ulceration on the posterior surface of the epiglottis, as seen in the mirror. Multiple ulcers soon form in other parts of the respiratory tract, extending below to involve the trachea, on the one hand, and upward into the pharynx, on the other. The ulcerative process may destroy the epiglottis.

In acute tuberculosis of the larynx the development and course of the disease are often so rapid as to result fatally in the space of only a few weeks. This is known as miliary tuberculosis. These areas of miliary tubercle are easily made to bleed by pressing upon them. The mucosa and submucosa become infiltrated, sometimes involving the mucous glands, and, as the disease advances, caseous degeneration occurs in the tubercles and adjacent tissues. In the acute form the membrane is seen to be congested, instead of pale, as is characteristic of the chronic form.

A peculiarity of this disease is that it may stop short at the vocal cords, in its downward course from the pharynx and through the larynx, and leave the cords unaffected, although the ventricular bands are involved even to the extent of so great tumefaction as to completely hide the vocal cords. Sometimes, however, the latter become thickened to such a degree as to threaten suffocation. The processes of infiltration, caseation of the tubercles, fatty degeneration of the mucous glands, and breaking down and melting away of the mucous membrane over these tubercular areas proceed until the whole of the interior of the larynx may become involved. The destruction continues until the cartilage itself becomes ulcerated, necrosed, and disintegrated. As seen in Plate VI, the cartilages are thickened until the indentations separating the cartilages of Santorini and Wrisberg are obliterated. The resulting tumefaction appears in the shape of a pear.

Etiology.—Tuberculosis of the larynx is usually consequent upon a pre-existing pulmonary consumption, although a primary lesion may occur in the larynx, as a result of the reception of the tubercle bacillus at a point on the mucous membrane where desquamation of the epithelium has occurred. Catarrhal affections, exposure to cold and wet and to an irritating atmosphere are predisposing causes. In pulmonary phthisis the lodgment of the tuberculous sputa from the lungs, as must occur in the larynx during expectoration, naturally tends to produce secondary points of inoculation.

Heredity is not emphasized as strongly as it was in former years, but inherited tendencies and weakness and a positive predisposition to tuberculosis cannot be denied, in the light of actual clinical experience.

Symptomatology. — The visible pathological conditions already detailed need not be repeated. The sensations of the patient are very positive in their character. Pain is often a conspicuous symptom, especially during the act of swallowing. The voice shows early the presence of a laryngeal trouble, and the hoarseness and feebleness may progress until no sound can be uttered.

When the posterior surface of the larynx is ulcerated the pain produced by swallowing may be excruciating. Sometimes the pain reaches to the ears, indicating ulceration of the pharyngo-epiglottic folds.

Difficult respiration is not a common symptom, but may result from great swelling of the vocal cords, abscesses, or the presence of detached pieces of necrotic cartilages or of tumors. One of the most common features of this disease is cough. Patients complain of sensations of irritation, at first described as a tickling in the throat or larynx. At this early stage the cough is of a hacking character and without expectoration. When ulceration takes place or abscesses form, or when pulmonary tuberculosis is progressing, the cough is attended with expectoration.

Diagnosis.—Generally an examination of the lungs will reveal the seat of the primary source of infection. As laryngeal tuberculosis may be associated with the same disease of the pharynx, inspection of the latter may disclose the nature of the malady. The laryngoscopic examination may bring to light the patches of miliary tubercle, but these tubercles cannot always be distinguished from hypertrophied racemose glands.

In the early stages this disease is likely to be confounded with simple catarrh, but, as the latter yields readily to treatment and presents no symptoms of gravity parallel with those of localized or general tuberculosis, in view of the history of the case, habit of body, probable involvement of the lungs, joints, or other structures, and the laryngeal appearances, one should scarcely err.

Prognosis.—Occasionally a case recovers; nearly all die. Acute tuberculosis of the larynx kills in a few weeks or months. In the secondary laryngeal tuberculosis consecutive to pulmonary consumption and characterized by caseation with acute symptoms, the disease proves fatal in from six to eighteen months. These cases may pursue a more chronic course and last from two to four years or longer. It is a difficult matter to cause a tuberculous ulcer to heal, and, if it does, it usually breaks out again.

From 10 to 40 per cent. of all patients with pulmonary tuberculosis have this laryngeal complication, which shortens the duration of life.

Treatment.—The treatment given in detail for tuberculosis of the pharynx is just as applicable here, and to avoid unnecessary repetition the reader is referred to that article for those remedies that are not given here.

Lennox Browne (*Journal of Laryngology*, etc.) maintains that curettement is not absolutely necessary in this disease. Menthol, or menthol with iodol, in spray is best in the pre-ulcerative stage. For pain he uses the ethereal solution of aristol in a spray. Morphia insufflations are used in hopeless cases only, but codeia largely, and cocaine before manipulations and in advanced dysphagia. Sprays are better than insufflations of powders. Excepting for relief of acute dysphagia, he prefers applications of the tincture-of-benzoin compound, tincture-of-camphor compound, and tincture of belladonna mixed with yelk of egg just before food. He employs lactic acid rubbed in with considerable force, but not employed previously to ulceration. The lactic acid is useless unless preceded by curettement once to about every four or six applications of the acid. He curettes for the removal of hyperplasia and to clear away the necrotic matter when the ulcers are large, and for converting all the ulcers into one.

J. Price-Brown relies largely on sprays in the early history of this disease. He says: "Of all the medicaments that can be applied in this manner, I have found none so useful as different percentages of menthol in albolene." He uses solutions varying in strength from 2 to 10 or 20 per cent.

Desiré recommends exalgin twice a day in doses of 4 grains as effective in relieving the difficulty of swallowing and pain. Wolfenden recommends feeding the patient while lying on his stomach while his head depends over the end of the couch, which is elevated so as to bring his feet higher than his head. He then takes liquid nourishment through a tube from the dish placed below his head.

The antitubercular serum of Paul Paquin has been used in a considerable number of cases of tuberculosis with benefit. I have been able to gather together reports from 369 cases that are of value, besides a large number that have been reported with such a degree of inexactness and indefiniteness that in giving the results it is necessary to eliminate them from the records. These ambiguous statements appear even more reassuring than the carefully prepared ones. Paquin has reported 293 cases, with the following results: Recoveries that seem permanent, 57; considerably improved, 38; improved, 121; disappeared from observation, 41; deaths, 36. I have reports of 76 cases to add to the above, giving the total results as follow: Recoveries, 71; improved, 205; unimproved, 14; disappeared, 41; deaths, 38.

Similar results from an oxygenated serum have been reported from San Francisco, but it is too early to speak judiciously regarding them.

Since the beginning of the year 1898 unfavorable reports from the use of Koch's tuberculin both in tuberculosis and lupus of the throat and nose have emanated from Munich, Hamburg, and Prague, although some improvement, rather than any cure, was recorded in the Berlin clinics.

When abscesses, growths, etc., produce so great obstruction to respiration as to threaten suffocation, tracheotomy must be done as a last resort.

SYPHILIS OF THE LARYNX.

Pathology.—Syphilis of the larynx belongs almost always to the secondary or tertiary stage. It is first manifested by the appearance of a deep blush of congestion of the laryngeal mucous membrane, characterized by dryness. A little later the mucosa becomes swollen by serous infiltration, and this stage is soon followed by shallow, ulcerating patches (Plate VII). The changes that take place in the larynx are similar to those occurring in the pharynx, but the results may be far more serious, owing to the diminished calibre of the larynx, which renders tumefaction and cicatricial contraction grave affairs. Mucous patches are likely to be found associated with the same lesions of the pharynx, and occur from three weeks to about three months or longer, following the initial sore. They are not found below the vocal cords, where there are no papillæ. When the papillæ are attacked they appear as small, red excrescences, swelling to the calibre of a small pea and obstructing respiration. From a rosy-red color they change to an ashy gray surrounded by a zone of red. They may disappear by the process of absorption or ulceration. A sudden infiltration of the mucous and submucous tissues is an occasional occurrence, and in this situation is of serious import, since the resulting œdema may impede respiration to the point of strangulation.

The tertiary stage is characterized by the presence of gummata, which become the seat of ulceration. When the erosions penetrate deeply into the submucosa the invasion of the blood-vessels gives rise to hæmorrhages. Following these deep ulcerations are found white, corrugated, contracting cicatrices that lessen the lumen of the cavity by their contractions. Adhesions of adjoining denuded tissues produce the same effect sometimes in a very short space of time. In this manner gross and obstructive deformities of the epiglottis, ventricular bands, and vocal cords give rise to a dangerous stenosis of the larynx.

In the later stages of tertiary syphilis the laryngeal muscles and cartilages are invaded, with the result of producing paralysis, as well as ankylosis and destruction of the cartilages.

Etiology.—Syphilis of the larynx is most often a tertiary lesion, occurring from three years to a much longer period after the initial ulcer. If it exist as a secondary manifestation, it follows the primary infection in a few weeks or months, the margin of the incubatory period in syphilis being very broad. These syphilitic invasions of the larynx are very rarely primary, and they are more frequent in men than in women.

Symptomatology.—As will be seen from the description of the pathological appearances in laryngoscopy, the first stage of syphilitic laryngitis closely resembles acute laryngitis of the simple variety. It may be impossible to distinguish early between the two unless a specific history can be obtained. But in the syphilitic form of congestion or inflammation the rosy hue of the mucous membrane assumes a comparatively mottled arrangement, which is quite characteristic of this affection. These patches of redness are likely to be elevated above the surrounding surface and to show early evidences of beginning erosions of a superficial kind. In this period sensations of soreness, difficulty of swallowing, and pain appear. The voice begins to change in quality; the pitch is lowered, and a coarse timbre is imparted to it. A slight cough makes its appearance, occasioning little inconvenience, and accompanied by a muco-purulent expectoration.

Inspection reveals the picture already described, resembling a simple laryngitis. The vocal cords may be involved sufficiently to show a congested condition (Plate VII), which may be bilateral when one side of the larynx is involved to a greater extent than the other. Mucous patches are most frequently found on the epiglottis, in the interarytenoid space, and on the ventricular bands. They do not differ in appearances from those described as occurring in the pharynx. Papillomata are occasionally present, and can be seen as little, wart-like excrescences, or they may assume the appearance of yellowish pimples, nearly as large as a small pea. The mucous patches may disappear in a couple of weeks, when subjected to treatment, and leave a blushing area that gradually fades from sight. The condylomata may become absorbed or may ulcerate away.

In the tertiary stage the epiglottis is most likely to be first invaded by the destructive process, ulcerations generally breaking out on the surface next to the tongue or on its border. From this region they spread to the laryngeal cavity, differing from the erosions of the secondary stage in their invasion of the deeper layers of the mu-

CHAPTER XXVII.

DISEASES OF THE LARYNX (*Concluded*).

TUMORS.

FOR convenience of description, tumors of the larynx are considered under two main headings,—"Innocent" and "Malignant" tumors.

INNOCENT TUMORS.

Benign, or non-malignant, tumors of the larynx arise as the result of various kinds of irritation,—such as inordinate use of the voice, great exposure to cold and wet weather, inhalation of air containing much dust, especially of a metallic nature, etc.

PAPILLOMATA.

Papillomata are more common than any other form of tumors of the larynx (Plate VII). They present widely-differing variations in size and physical appearances. They may be white or a light-red color, and the size of a bean or less, sessile and rough, single or multiple. Others resemble gray warts, springing from the vocal cord like little cones. These are most common in adult life. Children or young people are often subject to laryngeal papillomata, which assume a multiple form comparable to the raspberry or miniature cauliflower. They are rapidly regenerated after being removed. Indeed, all of these varieties may recur; but they may be very slow in returning, or they may not be reproduced at all.

Papillomata develop, not only on the vocal cords, but on the ventricular bands, and on the aryepiglottic folds, and they may attain to such numbers or size as to occlude a view of the cords, interfere with respiration, and stifle the voice. A guarded prognosis must be given when a papillomatous growth is found on one side and above the cord, or upon its margin in elderly people, since it is suggestive of laryngeal cancer. Indeed, laryngeal papillomata are prone to undergo transformation into carcinomata. (See "Treatment," page 314.)

management than tuberculosis and other affections of the larynx. In the early stages mercurials are indicated, while in the later periods the iodides are called for, or the mixture of the two, which is often more efficacious than the iodides alone.

The use of the voice, alcoholic stimulants, and tobacco must be interdicted, and in the secondary manifestation $^1/_{16}$ grain, or even more, of the bichloride of mercury may be given thrice daily. If the green iodide is employed, $^1/_6$ grain may be used. Inunctions of mercurial ointment may be resorted to if the stomach reject internal treatment, a drachm being rubbed into the skin. In ulcerations a spray of carbolic acid and iodine in lavolin, 4-per-cent. solution, is useful when thrown into the larynx so as to bathe the ulcerated surfaces. This has mildly anæsthetic and alterative effects and answers the purpose of a detergent and protective.

In the tertiary stage the mixed treatment has given the best results. I have generally prescribed the mercuric bichloride, $^1/_{16}$ grain, and the potassium iodide, 5 or 10 grains, to be taken three or four times a day in 1 drachm of syrup of sarsaparilla, well diluted. The doses are increased in size as tolerance will permit, care being taken that the stomach is not deranged by them. The ulcerations may require local treatment, such as has already been given under the heading of "Syphilis of the Pharynx." J. Solis-Cohen's favorite topical application consists of cupric sulphate in crystals or in solution, or chromic acid, 1 part in 4 or 10 parts of water. Nosophen and aristol may be dusted over the ulcers with the throat powder-blower (Fig. 83).

Paralyses usually yield to the constitutional treatment, but it may be advisable to employ electricity and strychnia.

Contractions and tumefactions may occur sufficiently to cause strictures and stenosis of the larynx. If the interference with respiration is considerable, the aponeurotic membrane and other adventitious tissue must be incised or removed (Fig. 102), or they can be divided and destroyed by means of the galvanocautery. When extreme stenosis threatens suffocation, intubation or tracheotomy must be performed. Since the cicatricial tissue of syphilitic origin is little susceptible of dilatation, a tube may have to be worn permanently after tracheotomy. Schrötter has devised laryngeal dilators to be inserted at first by the surgeon and later by the patient. These are left in position as long as the patient can endure them, using sizes of increasing calibre. They are used daily to increase the lumen of the laryngeal aperture, taking from six to eighteen months to effect a permanent dilatation.

PLATE VII

PLATE VII.

FIGURE 22.—Syphilitic infiltration of the arytenoid cartilages and the right vocal cord; gummata of the right half of the epiglottis.

FIGURE 23.—Tertiary syphilitic ulceration of the epiglottis and the right arytenoid cartilage; great thickening and congestion of the epiglottis and of the arytenoid cartilages.

FIGURE 24.—Pachydermia laryngis, the growth springing from the posterior portion of the left vocal cord, causing a corresponding depression in the right cord.

FIGURE 25.—Pachydermia of the larynx, twin tumors springing from the posterior portions of the vocal cords; the convex surface of the left growth fits into a corresponding depression in the right.

FIGURE 26.—Pachydermia laryngis located in the interarytenoid space.

FIGURE 27.—Papilloma growing from the anterior portion of the right vocal cord, preventing close approximation of the cords in voice-production.

FIGURE 28.—Papilloma of the left vocal cord, presenting an appearance suggestive of a raspberry.

FIGURE 29.—Multiple papilloma of the larynx completely covering the vocal cords.

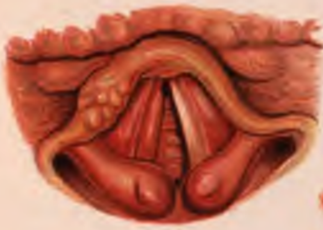
FIGURE 30.—Fibroma of the right vocal cord producing hoarseness and, finally, aphonia.

FIGURE 31.—Carcinoma of the larynx, ulceration and necrosis of the left arytenoid cartilage, and paralysis of the left vocal cord.

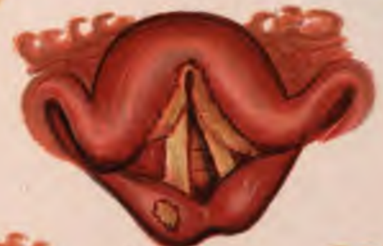
FIGURE 32.—Unilateral paralysis of the adductors of the left vocal cord, as seen during an effort at voice-production.

FIGURE 33.—Unilateral paralysis of the left abductor, as seen in forced inspiration. The left cord is in the cadaveric position.

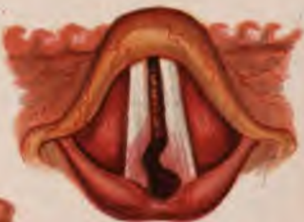
PLATE VII



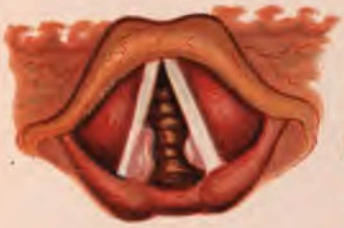
22



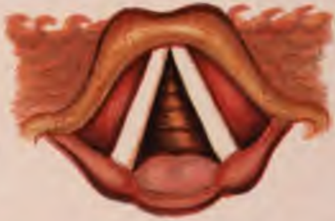
23



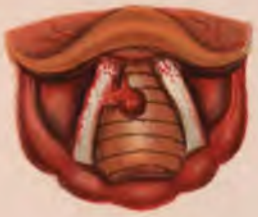
24



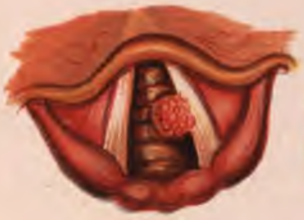
25



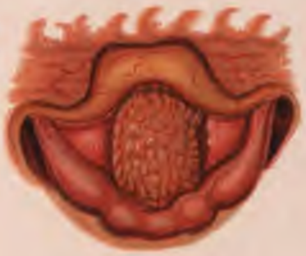
26



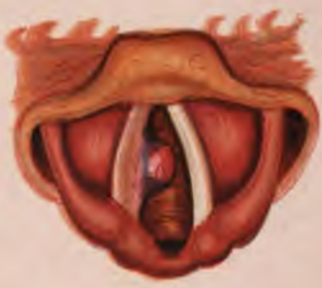
27



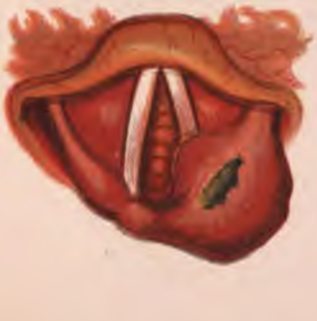
28



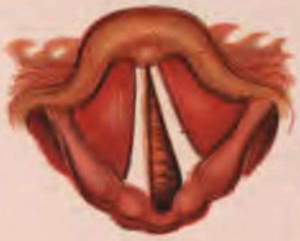
29



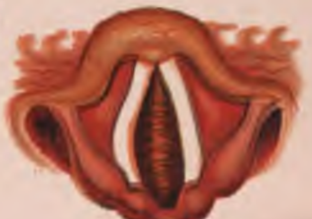
30



31



32



33

FIBROMATA.

Fibromata usually develop near the anterior extremity of the vocal cord (Plate VII). These tumors vary from a gray to a deep-red color, and they may be attached by a broad base or by pedicles. They are generally solitary, and present a smooth surface, but when a large size is attained they may become lobulated. Their size varies from that of a small pin-head to a pea, or, indeed, they may fill the larynx; but such an enormous development is seldom seen. When touched with an instrument they impart the feeling of a firm, dense tissue. Their removal is followed by more satisfactory results than obtain after operations on other tumors of the larynx, for they do not often reappear. (See "Treatment," page 314.)

MISCELLANEOUS.

Other very rare specimens of growths may be found in the larynx. Polypoid excrescences, such as mucous polypi, or myomata, sometimes make their appearance in the vicinity of the anterior commissure. They are attached by peduncles, and have a pale or red, smooth surface. Occasionally the epiglottis is the seat of a cystic tumor which presents a regular, rounded surface.

Vascular, fatty, and cartilaginous tumors are so very seldom met with as to require a description in exhaustive works only. The symptomatology and treatment are the same for these as for laryngeal tumors generally.

Symptomatology.—The symptoms are those characteristic of obstruction to respiration, phonation, and deglutition. Respiration is not interfered with in the early history of a laryngeal growth unless it is located in close proximity to the vocal bands or unless it is of rapid growth, so as to attain a large size and materially encroach upon the lumen of the respiratory space. With the increase in the bulk of the tumor, difficulty in respiration increases until it may end in asphyxia, unless relief is afforded. The voice may not be impaired if the tumor is situated sufficiently above the vocal cords to prevent any embarrassment of their vibrations. Should the growth be located on one of the vocal cords it acts like a damper, impeding the movements of the cord in response to the column of air, and, if it rest between the cords, it prevents their approximation and not only causes dysphonia, or difficulty in the production of the voice, but it changes its quality and interferes with respiration. The vocal bands then cannot be normally approximated, and the breathing-space between the cords is lessened in degree, according to the size and shape of the growths. Difficulty in swallowing occurs as a result of the location of the tumor where it prevents closure and perfect coaptation of the epiglottis over the entrance to the larynx. If it is seated upon the posterior surface of the epiglottis, as it presents in the laryngeal mirror, the same effect may be produced. Cough may or may not be a symptom, but it may be present as a result of the inability to evacuate easily the accumulations of mucus, which then act like a foreign body, or in case the tumor is of such a kind as to vibrate in the currents of air and thus produce a tickling or cough-provoking irritation. Patients with benign tumors seldom complain of suffering pain.

Prognosis.—So far as the question of life is concerned, one is able to give a favorable prognosis in the case of an innocent laryngeal neoplasm. Should the growth reach such proportions as to render death imminent by asphyxia, tracheotomy will avert a fatal termination. If the tumor be not removed by an endolaryngeal operation, thyrotomy may be resorted to, although the effect on the voice is better in endolaryngeal operations, more especially when the tumors are readily accessible and pedunculated. As has been already remarked, there is a strong tendency to regeneration of the growths after operations for the removal of papillomata.

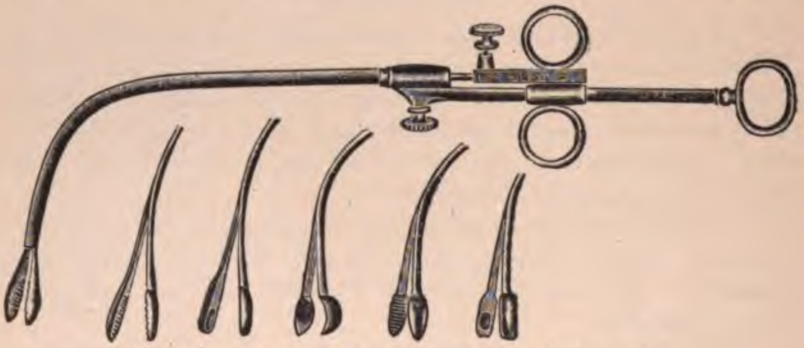


Fig. 102.—Tobold's Set of Six Forceps, Knives, etc.

TREATMENT OF INNOCENT TUMORS OF THE LARYNX.

There are numerous methods for the removal of tumors of the larynx. Forceps, knives, and curettes (Fig. 102) have been devised for this purpose. Snares, the galvanocautery, and caustics are in general use to effect the same results.

When the growths have not attained a considerable size and are not easily engaged in an instrument, chemical caustics are applicable. Before any operative procedure the interior of the larynx should be anæsthetized with a 20-per-cent. solution of cocaine. Chromic acid, preferred by Jarvis, is fused into a bead of proper size and shape on the flexible applicator (Fig. 182) and accurately applied to the surface of the growth. Silver nitrate can be similarly employed, fused in the same manner on the platinum-wire loop of the applicator.

In making applications of caustics, or in manipulating any instruments in the larynx, the operation is done by the aid of the laryngeal mirror, so that every movement and the relations of all the parts can be closely watched. It must not be forgotten that the movements of the instruments in the larynx are directly opposite to the movements as seen in the mirror, everything being reversed. The utmost care must be exercised, or injury will be inflicted on the surrounding tissues that will be, perhaps, far more serious than the original trouble.

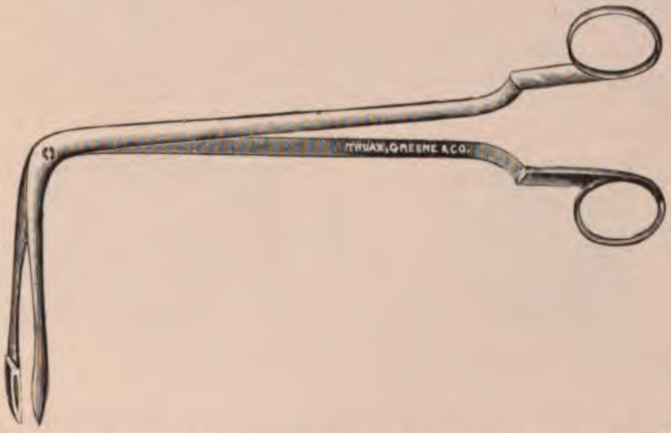


Fig. 103.—The Author's Long Antero-posterior Laryngeal Forceps with Biting Edges.

Lennox Browne prefers the snare for the removal of growths. Dundas Grant has devised guarded cutting-forceps that take as firm a grip upon the tumor as Mackenzie's instruments. Much care must be exercised that a tumor once severed from its attachment does not drop back into the larynx as it is being removed. Evulsion of laryngeal tumors is preferred by some operators. For this purpose the strong forceps of the author afford a firm grip upon the growths (Figs. 103 and 107). These instruments are used without great difficulty if the larynx is properly anæsthetized. This is accomplished if the cocaine solution is applied two or three times at intervals of five minutes. The benumbing effect of cocaine in the larynx is very transitory, not extending over ten minutes, so that operative measures must not be prolonged without renewed anæsthesia.

The following case presents a unique feature, in that it was impossible to remove all of the laryngeal growths with any instruments that were obtainable, but that no difficulty was found in operating with the special instrument shown in Fig. 103. The case was that of a man 50 years old. In 1895 he had experienced some annoyance from hoarseness; in December, 1897, he had a "cold in his throat," resulting in a loss of voice for two days; in the following summer the hoarseness returned and grew worse until, in November, 1898, there was complete suppression of the voice. The aphonia remained until the last of the papillomata were removed in January, 1900.

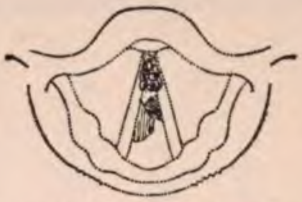


Fig. 104.—Laryngeal Papillomata.

Examination disclosed the condition shown in Fig. 104. The anterior commissure was filled by a pale-pink, lobulated mass resembling certain adenoid growths in the vault of the pharynx. Adjoining this mass was a growth on the left vocal cord, situated a little nearer the anterior than the posterior end. Nearly opposite this was a similar, though larger, tumor having a broad base, and projecting from the border of the band to meet the opposite tumor in such a manner as to bring its anterior surface in contact with the posterior surface of its fellow. The pressure of these two papillomata against each other produced a marked depression in the right one. These twin tumors presented the appearance of gray warts of a minute cauliflower formation, and together with the third growth occasioned not only suppression of the voice, but obstruction to the column of air, although the respiration was not yet embarrassed sufficiently to cause great distress.

My first efforts were directed toward the removal of the mass filling the anterior commissure. I attacked it with Mackenzie's biting forceps and with the crushing forceps, but found that none of the usual instruments would reach it; then I bent an electrode in such a way as to afford a very long laryngeal extremity, and with this I destroyed the large mass.

However, the patient was averse to the use of the electrode, and conceived the idea of having an extralaryngeal operation, but fortunately was convinced that the results of endolaryngeal operations were far superior to those obtained from entering the larynx from without. By using the longest Mackenzie biting forceps obtainable I removed the mass shown at the actual size in Fig. 105. The larynx was situated so low that it was necessary to press with extraordinary force on the forceps in order to reach low enough to obtain this much of the growths, and it was impossible to reach more with the instruments then in use. Dr. O. J. Stein kindly made attempts with his, and had the same results.

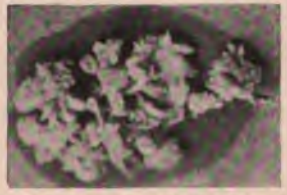


Fig. 105.—Laryngeal Papillomata.

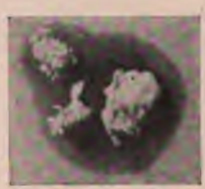


Fig. 106.—Laryngeal Papillomata.

Then I had an especially long biting forceps made, with which I was able to remove the remnants of the two neoplasms. After the one on the right cord was taken away, there was revealed a growth below the cord, which was readily reached and removed by directing the long cutting blades of the forceps well under the band. Fig. 106 shows the actual size of the growths that were taken entirely by the special instrument (Fig. 103), which is three-fourths of an inch (eighteen millimetres) longer in the laryngeal extremity than the longest instrument I could find.

Since the operation the voice has gradually improved in strength and timbre, and under date of March 11, 1900, the patient reported as follows: "I am most delighted to inform you that my voice continues to improve; it is now almost normal, or as good as it ever was. I can halloo and, I believe, make a very fair stump speech," etc.

In another similar case it was impossible to engage in the jaws of the forceps several papillomata that sprung from the surface below the anterior insertion of the vocal cords. The writer then devised a biting forceps corresponding in every particular to the long ones shown in Fig. 103, except that they opened laterally instead of antero-posteriorly. With this instrument (Fig. 107) most of the tissue was removed, but enough remained to necessitate the use of the electric cautery. However, no electrode that could be found was of sufficient length to reach the seat of the growths. The author then constructed the laryngeal electrode shown in Fig. 108, with which he experienced no difficulty in thoroughly cauterizing the attachments of the growths.

When operating in the larynx, one ought always to have his tracheotomy instruments at hand, for instances have occurred in which spasm of the glottis has immediately followed the procedure, necessitating opening the larynx to prevent a fatal suffocation.

Ephraim Cutter was the first to perform laryngotomy for the removal of a laryngeal tumor. This must sometimes be done when the growth cannot be extracted in the usual way. An incision is made into the angle of the thyroid cartilage, the tumor removed, and the wound closed.

PACHYDERMIA LARYNGIS.

Virchow and Fränkel were among the first to describe a thickening of the mucous membrane covering the free edges of the vocal cords and lining the interarytenoid space, and especially in the region of the vocal processes (Plate VII).

Pathology.—There is a great increase in the thickness of the epithelium, and in the number of papillæ, and horny changes in the outer cells. The tendency is to the formation of oval tumors, and when they occur on the vocal cords there are frequently two seated opposite each other. In this case the apex of one fits into a depression in its fellow. The interarytenoid pachydermia is not so often seen as the growths upon the cords. The color is whitish gray or possibly pink.

Etiology.—Pachydermia is found more often in middle-aged men than in women, and they are probably caused by excessive use of the voice, tobacco, and alcohol.

Symptomatology.—There are huskiness of the voice, sensations akin to a foreign body, possibly dull aching, and even labored breathing and painful swallowing. The neoplasms may attain to so large a size as to suppress the voice. In such cases the tumors assume a pink color.

Diagnosis.—The symptoms are generally much less pronounced than in malignant disease. The interarytenoid growth is suggestive of tubercular infiltration, but the latter is more clearly defined, is of a deeper red color, and produces more disturbance than the former. Moreover, pachydermia more often occurs in the form of symmetrical, or twin, tumors on some part of the free margins of the vocal cords. The unilateral form of this tumor, known as singer's nodule, might be mistaken for a fibroma. Pachydermia is found most frequently on the posterior portions of the vocal cords, while cancer generally occurs on the anterior parts.

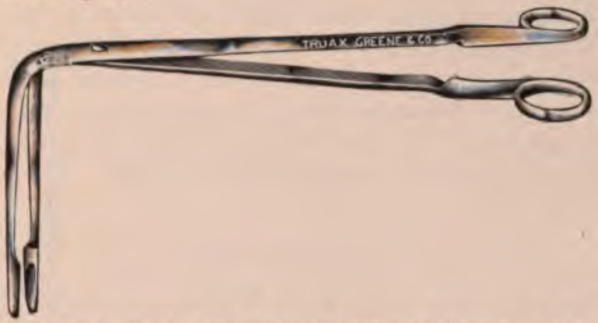


Fig. 107.—The Author's Long Lateral Laryngeal Forceps with Biting Edges.

Prognosis.—The outlook is favorable to life, but unfavorable in respect to the voice, when the growths occur on the vocal cords. When they are situated in the interarytenoid space the vocal functions may not show impairment.

Treatment.—Measures should be first addressed to the correction of any catarrhal conditions that may be present, along the lines already laid down in previous pages. In addition to local treatment potassium iodide should be administered in moderate doses. When the voice is affected, strong astringents, such as a 10-per-cent. solution of silver nitrate, may be applied, or the electric cautery may be resorted to. If the tumor is of sufficient size to permit grasping it with instruments, it should be crushed by the biting forceps (Figs. 103 and 107).

In a discussion on this subject before the Twelfth International Medical Congress, in Moscow, August, 1897, Heryng spoke of the operative treatment of the vocal cords affected by a pachydermatous condition resulting from repeated attacks of catarrh. He remarked that "it was not the beautiful pearly-white cords that produced the finest voices, this pearly whiteness often being produced by numerous layers of thickened epithelium. Some of the best singers had distinctly red, catarrhal-looking vocal cords; for example, Jean de Reszke's vocal cords were slightly red before, and very red after, singing. One should be in no hurry to treat a singer's larynx in any radical way." He especially warned young laryngologists to be extremely careful in their dealings with singers. It is easy to understand why pachydermia is frequent among them. They are exposed by the nature of their calling to frequent catarrhal attacks; they are prevented from obtaining proper treatment for each attack; they are compelled to sing whether it prove detrimental to their voices or not; and, although overindulgence in eating, drinking, and smoking are destructive to singing voices, "nearly every singer smokes too much, eats too much, and drinks (alcoholic beverages) too much. By these means a slight catarrh or cold easily becomes chronic, and proceeds to produce pachydermia." (*Medicine*, March, 1898.)

MALIGNANT TUMORS.

Malignant growths of the larynx are not uncommon. They may be classed as carcinomata and sarcomata.

CARCINOMATA.

These are commonly known as cancers (Plate VII), and are, by far, the most frequent of malignant growths in this locality. Bosworth reported, as a result of a collective investigation of the subject, that, out of three hundred and thirty-four published cases of malignant growths, two hundred and four were cancers and one hundred and thirty were sarcomata.

There is considerable variation in the nomenclature of this subject. Browne treats of cancer under two headings: "Epithelioma" and "Alveolar Epithelioma" (adenoid, scirrhous, or encephaloid cancer). These growths may occur as primary diseases of the larynx or they may result from an extension to this organ from adjacent tissues.

Pathology.—The identity of epithelioma cannot be determined positively by the mere evidence of a microscopical examination showing a proliferation of epithelium and cell-nests. It is settled that the process is of a malignant character only when the epithelial proliferating process invades the underlying connective tissue and its infiltrating nature is established. The disease more often originates on the ventricular bands than on the vocal cords. In the early stage of cancer the tissues present an hyperæmic and indurated appearance, which gradually extends to the surrounding structures. The thickening increases irregularly until a more or less well-defined tumor results; the enveloping membrane softens, breaks down, and the stage of ulceration is established, with its widespread destruction of the parts involved. Excision of a deep portion of the growth may be made for a microscopical examination.

Fig. 108.—The Author's Laryngeal Cautery Electrode.

Etiology.—Heredity is an important etiological factor, and any occupation or habit that excites a constant irritation of the tissues, according to Virchow, may result in converting an innocent neoplasm into a malignant growth. Cancers usually do not occur before the fortieth year.

Symptomatology.—The effect upon speech and articulation will depend upon the situation of the tumor. If it belong to the intrinsic form,—that is, if it attack the subglottic space, the vocal cords, the ventricles, or the ventricular bands,—the voice is more or less seriously affected. Should the growth be limited to the arytenoid cartilages, the sinus pyriformis, the aryepiglottic folds, or the epiglottis, thus constituting an extrinsic laryngeal neoplasm, the voice may not be markedly changed. When infiltration extends to and includes the laryngeal muscles, interfering with their functions, the voice is altered according to the muscles affected. Hoarseness may exist from near the beginning of the growth, and later the voice may be entirely lost.

In the intrinsic form not only the voice, but respiration, is embarrassed. Cough may not be present until ulceration has occurred, when a purulent expectoration appears. In deep erosions, necrotic tissue stained with blood and characterized by a very offensive odor appears in the sputa. In the final periods of the disease difficult deglutition is present, especially in the extrinsic variety of tumor.

Pain, the label of malignant growths, is an invariable symptom. It is likely to radiate through the neck into the pharynx, and, as occurs in tuberculosis of the larynx, it extends to the ears. So constant and conspicuous a symptom is the involvement of the ears in pain that von Ziemssen considered it pathognomonic of laryngeal cancer. The general appearance of the patient after a long duration of the disease corresponds to the condition called by that classical alliterative term "cancerous cachexia."

Inspection shows the location of the growth. At an early date only a thickened or nodular condition of the mucosa may appear, of a gray or deep-red color. When the epithelium is desquamated and the ulcerative process is established, a granular proliferation of the tissues springs up about the border of the erosion. Fungoid growths are seen sprouting from the surface of the ulcer, only to succumb to the necrotic process later. As the disease advances the destructive process becomes so great as to cause abscesses; the cartilages are attacked, and portions of necrosed cartilage are loosened and expectorated; hæmorrhages occur; the breath is foul; the larynx becomes constricted, and, unless surgical interference be resorted to, death ensues.

Diagnosis.—Laryngeal cancer is not always easily distinguished from other affections in which there is tumefaction or ulceration In chronic hypertrophic laryngitis and in pachydermia laryngis the hyperæmia and thickening of the mucous membrane simulate the early stage of cancer, but in the former diseases we will note the absence of pain, ulceration, infiltration of the cervical glands, and the microscopical appearances. However, it should not be overlooked that a microscopical examination of a section of a tumor may show .that the portion removed is non-malignant, while it does not prove that the whole growth is benign.

The author could cite repeated instances in which many careful microscopical examinations have been made by different bacteriologists, when their conclusions were not borne out by the ultimate clinical results. So frequently are the histological evidences, interpreted by the microscope, negative in character, it is all the more incumbent on the clinician to exercise the utmost patience and skill in determining the differential diagnosis.

In this connection it is interesting to recur to the discussion on this subject which took place at the meeting of the Twelfth International Congress, at Moscow, in August, 1897. Chiari reported 70 cases of carcinoma laryngis occurring under his own observation. Comparing the clinical with the microscopical diagnosis, he maintained that, when the clinical evidences favored a diagnosis of cancer, a negative microscopical examination was not to be considered, whereas positive microscopical evidences obtained by a thoroughly competent microscopist must outweigh clinical evidences to the contrary.

Hajek claims that intrinsic and extrinsic carcinomata of the larynx are to be put into two totally separate categories, the former being much milder in its course than the latter, on account of the very poor supply of lymphatics to the larynx. Carcinoma on the posterior wall of the larynx is rare; when occurring at that situation it is difficult to diagnose. Pachydermia, as a rule, occurs on the posterior parts of the vocal cords, whereas cancer occurs on the anterior portions. Pachydermia is almost always bilateral, but cancer is unilateral. "The lazy, limited movement of the vocal cord, so much spoken of in cancer, is hardly a trustworthy symptom, because it is often absent in cancer and present in pachydermia. Much more valuable is the fact that pachydermia appears, on laryngeal examination, to be a growth on the vocal cord, while a commencing carcinoma does not appear as a growth at all, but rather as an indefinite thickening of the cord itself, of which one cannot say where it begins and a healthy cord ends." (*Medicine*, January, 1898.)

From papilloma, cancer may be distinguished by the facts that these warty growths occur in early life, as a rule, while carcinoma is usually found in persons past middle life. Papilloma is a more clearly defined tumor, while cancer presents an irregular infiltration and thickening. The cancerous cachexia and pain, also, are to be remembered as characteristically distinguishing features. If the cancer be extrinsic, enlargement of the lymphatic glands in the vicinity may be found.

In tuberculosis of the larynx there are the characteristic cough, pulmonary complication, history of consumption, lighter color, and less swelling of the tissues preceding ulceration. After ulceration sets in it is not likely to erode the tissues as deeply as cancer does. The absence of the bacillus of tuberculosis is only negative bacteriological evidence, for the author has watched the destructive process do its deadly work through long, weary months to a fatal termination, while various microscopists and bacteriologists utterly failed to discover a single bacillus.

From syphilis it is sometimes difficult to distinguish epithelioma, especially from the gummatous stage of the former. Gummata, however, ulcerate early in most cases. The question is simplified if the history be obtainable. Comparing the ulcerative stages of the two diseases, it is not an easy problem to solve. Now comes the most reliable test. If it be syphilis, the exhibition of the iodides will cause a progressive clearing up of the symptoms, and the improvement continues; while, in the case of cancer, although there may be a perceptible improvement for a short time, this benefit is soon lost and the patient retrogresses in spite of the iodides. But the syphilitic increases in weight, and shows a general improvement as well as marked mitigation of the local symptoms.

From innocent growths it may be exceedingly difficult to differentiate cancer in its early history, but the manifestations of the cancerous tumor are more pronounced than those of non-malignant neoplasms. The pain, age of the subject, and the appearances of the various tumors already described, taken with the history of the case, will form a group of facts that will tend to the formation of a correct diagnosis.

Prognosis.—According to Mackenzie, the average duration of the encephaloid cancer of the larynx is three years. Browne gives twelve months as the limit of life after removal of epithelioma. The results of tracheotomy are more favorable than those of thyrectomy or thyrotomy. No operation cures; starvation, hæmorrhage, or asphyxia ends life.

Treatment.—By certain methods of treatment life may be prolonged and rendered less miserable. From a humanitarian point of view, if it were justifiable under any hopeless circumstances to relieve a fellow-being of his misery and despair by the merciful production of euthanasia, cancer of the larynx is that case. Death constantly stares his victim in the face, and, what is worse, like the burning coal in the eye of Cyclops, pain, in all its variations and refinements of torture, converts the patient's world into a chamber of horrors. No words can depict the agonies of these coughing, choking, strangling sufferers.

Local anæsthetics and anodynes must be added to detergents and antiseptics. Sprays of cocaine and morphia in ethereal solutions are indicated for the alleviation of pain. Aristol and iodoform may be used in the same manner.

Chloroform and belladonna liniment may be employed for external applications. Steam-inhalations containing conium and benzoin may prove grateful.

One should bear in mind that there is always a possibility of a syphilitic taint, which would yield to specific treatment, and a trial of the effects of sodium or potassium iodide should be made.

Operative measures may relieve the immediate suffering from impending suffocation, and they may prolong life for several months. In October, 1895, Roswell Park reported a case of total extirpation of the larynx for epithelioma. Fourteen weeks after the operation the patient presented himself at the clinic "the picture of health." Operations within the larynx are deprecated by some authorities: Browne and Newman. Galvanocauterization produces only temporary benefit. Tracheotomy offers the greatest promise of relief from suffocation and may prolong life from two to four years.

Chiari's best results have been obtained from an operation, laryngofissure, when it is required to excise a vocal cord or false cord only. "This method, which is not attended by danger, insures a good voice and respiration, and it obviates the necessity of wearing a tube." It is only for intrinsic carcinoma that partial or total resection should be practiced. Krause maintains that the results from laryngofissure are not often permanent, recurrence taking place some time later. In fourteen of his cases treated by total extirpation of the larynx there was but a single death. In these cases the new method—in which the end of the trachea is stitched to the skin—was employed. This closes the communication of the trachea with the throat by stitching the mucous membrane, and by the use of tampons.

SARCOMATA.

These are very rare tumors of rapid growth, and attain to a large size. Their appearances differ widely, sometimes resembling fibromata or papillomata. Only a microscopical examination can give a positive diagnosis. They do not kill as quickly as epithelioma does, but are destructive of life sooner or later. They should be removed by some of the methods already described for the extirpation of other tumors. Max Toeplitz reports a case of chondrosarcoma cured by intralaryngeal operation.

FOREIGN BODIES IN THE LARYNX.

During inspiration while eating, or in the act of laughing, foreign bodies are drawn near or into the larynx, where they find lodgment. Lefferts reported a case in which a brass watch-ring became imbedded so as to rest astride the aryteno-epiglottic fold and ventricular band, where it remained four years.

Symptomatology. — The presence of any foreign body in the larynx excites most violent coughing and symptoms of strangulation. If the body is of such a size and contour as not to completely fill up the lumen of the canal, breathing may proceed until the reflex spasmodic efforts at dislodgment succeed in expelling the body. When the entrance to the larynx or the glottis is completely obstructed, suffocation may take place before relief can be obtained, the patient dying in a few minutes. Boluses of meat and other soft substances that apply themselves closely to the inequalities of the cavity are the most common causes of death from foreign bodies. But rough bodies may set up such an inflammation before their extraction that œdema of the larynx or pneumonia may result.

If the body is coughed up, considerable soreness and pain may be experienced for a few days afterward. Small foreign particles sometimes remain for a long time in the larynx before being thrown out by coughing or sneezing. They may give rise to an irritation that leads to a serious lesion of the mucosa.

Treatment.—The finger can sometimes be made to reach and dislodge the body if it is in the vicinity of the entrance to the larynx. A common remedy is to slap the patient on the back of the shoulders just as he makes an expiratory effort. Gravity may be brought into play in case of a foreign body with some material weight. The patient may be held with the feet upward and the head pendent while expulsive efforts are made by the patient.

Sharp-pointed articles penetrate the walls of the larynx sufficiently to arrest their onward progress, and the coughing, retching, and gagging serve to force them farther into the tissues. All the sensitive area should be treated to a 20-per-cent. solution of cocaine, and by the aid of a mirror the object should be located. Then the laryngeal forceps (Figs. 103 and 107) may be made to grasp and extract the offending invader.

If failure attend the attempt to extract the foreign substance. and strangulation is impending, tracheotomy must be done without delay. If proper instruments are not at command, a pocketknife will do, and retracting hooks can be improvised with safety-pins, hair-pins, or the like until sufficient conveniences can be supplied.

PART IV.

Diseases of the Ear.

CHAPTER XXVIII.

A GENERAL CONSIDERATION OF DISEASES OF THE EAR, NOSE, AND THROAT BASED ON A STUDY OF TWENTY-ONE THOUSAND CASES.

THE following statistical data represent the records of 21,000 cases treated during seventeen years at one of the author's clinics in Chicago. The first series formed a part of a report made by the writer to the Ninth International Medical Congress, in 1887; the second was compiled for me by my assistant, Charles L. Enslee. A relatively small number of unselected cases have been added from the records of my private practice to supply the place of those whose records were incomplete. The first classification was instituted for the purpose of establishing a basis of calculation of the influence, if any, exerted by occupation, age, or sex in the causation of ear diseases. The condition of each patient at the time he first presented himself at the clinic is given in order to determine the relative frequency of the different diseases.

As is common in charity hospitals, a considerable number of those who applied for treatment belonged to that class of laboring-people who have no definite trade or fixed occupation. In order to facilitate investigation and simplify the study as far as possible, all those occupations that were closely related to each other in nature and effects were grouped under one heading. For example, under the classification of clerks were embraced salesmen, bookkeepers, office employees, etc.; with teamsters were grouped car-drivers, peddlers, etc.; cooks and bakers were classed together; brass-molders, iron-molders, etc., were classified with iron-workers; plumbers, gas- and steam- fitters appear together; such closely allied occupations as stone-cutters, stone-masons, brick-layers, and plasterers, in which the influences and exposures are very similar, are grouped together under the head of day-laborers,—a term borrowed from the laborers themselves.

The combined data show that, of the 21,000 cases, there are 11,167 patients with occupations, classified under 28 headings. Of this number, 3813 had out-door and 7354 in-door work. In the as compared with diseases existing coincidently in both ears. The second study shows that in acute inflammation of the middle ear there is but a very slight difference in the frequency of involvement between the two ears, not referring to the question of sex, and both ears were affected in 43 per cent. of all the cases. In acute suppuration of the middle ear, again, there is too little difference between the two ears to take into account. In 15 per cent. of all these cases both ears were involved.

In 2790 cases of unilateral ear diseases which the author has investigated to determine which ear was the more frequently affected, especially with reference to the question of sex and its influence, first in children under 15 years of age, and, second, in adults, the results are as follow: There were 456 boys with affections of one ear only, of whom 245 had diseases of the right ear, and 211 diseases of the left ear, an excess of about 7.6 per cent. of right-ear affections. Of 569 girls, 334 had diseases of the right and 235 diseases of the left ear, or an excess of 17.4 per cent. of affections of the right ear. This shows that out of the total number of 1025 children under 15 years there was an excess of 25 per cent. of diseases of the right ear.

Of 1046 men, 472 had diseases of the right ear, and 574 of the left, or an excess of about 10 per cent. of affections of the left ear. There were 719 women, of whom 363 presented troubles of the right ear, and 356 of the left, or an excess of diseases of the right ear amounting to a trifle less than 1 per cent.

In the 5809 cases of chronic non-suppurative inflammation of the middle ear the two sides were about equally affected, but a great contrast is now offered in the relative frequency with which both ears are involved in the various middle-ear diseases, for in this instance nearly 82 per cent. of all the cases presented bilateral aural affection. Sufficient importance must be attached to these undeniable figures in formulating our prognosis when only one ear is already diseased, for it follows, almost as the night the day, that if one ear has become seriously affected, especially with the sclerotic form of dry catarrh, the other falls under the same destructive process.

In chronic suppurative otitis media the two ears suffer nearly equally, and it appears that both ears are simultaneously affected in a little more than 60 per cent. of the cases. In 3185 instances of unilateral ear diseases there was an excess of only 23 cases of the right over the left ear. This fact is mentioned particularly because the opinion has often been expressed that one ear was much oftener affected than the other, some specialists believing that the right was by far the more frequently diseased.

The data show that about 13 per cent. were afflicted with naso-pharyngeal diseases, but the actual number would be far in excess of this figure. The institution being an eye and ear hospital strictly, not as great prominence has been given to the nose and throat affections as would be desirable, this part of the diagnosis sometimes being entered on the patients' cards instead of upon the record-books.

About $^8/_{10}$ of 1 per cent. had diseases of the mastoid process, which was nearly twice as prevalent in males as in females.

Deaf-mutes formed about $^1/_2$ of 1 per cent. of the 21,000 cases. There were three times as many males as females.

The largest number of any one class of diseases was 8827 with chronic non-suppurative inflammatory processes of the middle ear, or 42 per cent. of the whole number. Next in numerical order come 3664 cases of chronic suppurative inflammation, or 17 per cent.; and the next highest number 1009 cases of acute suppuration, or 5 per cent.

American residences and business houses are heated in cold weather by dry, hot air and kept at a temperature of 70° F. or higher. The inmates are subjected to the action of this dry heat, often laden with dust and noxious gases, the greater part of every day. The skin, consequently, is very active in its functions, and kept moist by free perspiration. But, though constant exposure renders the soldier, Spartan-like, indifferent to cold and storms, housing the body makes it tender, like the hot-house plant, and sensitive to sudden and extreme changes in the air. After working all a winter-day in a temperature of summer-heat, these people, with the powers of resistance reduced by fatigue and hunger, pass out immediately into a frigid atmosphere, with the temperature perhaps from 40° to 70° F. lower than that of the workshop. The skin is chilled, the perspiration checked, and a determination of blood to some internal organ occurs. Naso-pharyngeal catarrh is probably the most frequent consequence. This result is aggravated by high winds and the inhalation of dust. In fact, a very large percentage of naso-pharyngeal catarrh is undoubtedly due to the irritating effects of dust, and this, operating in conjunction with cold, damp air, is largely responsible for the widespread existence of naso-pharyngeal catarrh among Americans. It is undoubtedly the most prevalent disease in the United States. The importance of this fact is obvious when we consider that so large a number of middle-ear affections originate in naso-pharyngeal inflammation which extends through the Eustachian tube to the tympanum. Critical examination of the nose demonstrates the existence of nasal trouble in a large proportion of these cases. Hence, whatever causes a catarrh of the nose and throat is interesting to the otologist as a proximate cause of ear disease.

The exanthemata are frequent causes of ear diseases during childhood, but youth seems to predispose to coryza, which is often a forerunner of tubal and tympanic catarrh. Children under 15 years of age constitute about 29 per cent., or more than one-fourth of the whole number of cases. Very many of them dated back to attacks of scarlet fever, measles, and the earaches and "running-ears" of infancy; so that a much larger percentage than appears should probably be credited to the period of childhood. Only a small proportion of children were brought for treatment during the acute stage of inflammation. Only about 10 per cent. were acute cases, leaving 90 per cent., or nine times as many, who had not applied for treatment until the inflammation had reached a chronic stage. Indeed, only 13 per cent. of the adults were seen in the acute stage.

The data show a large percentage of diseases of the external ear. Since impacted cerumen may be regarded as a symptom and a consequence of chronic non-suppurative inflammation of the middle ear, due consideration should be given this fact in estimating the relative frequency of affections of the middle and of the external ear as shown in the data.

It may be permissible to cite a few facts that do not appear in the statistics, but which, nevertheless, were impressed upon me by a personal study of this class of patients. Although the whole State of Illinois contributed largely to the number embraced by these observations, a large majority were residents of Chicago,—a very cosmopolitan city. The foreign element predominates. The nationalities were not recorded except in resident infirmary cases, but the Irish constituted a very large and the French a very small percentage of our clinical material. The north of Europe furnishes a far greater percentage of our population than the southern portions. After considering the nationalities it will not be surprising when it is stated that the blondes exceed the brunettes in number.

Another matter of interest to the etiologist, and to the student of sociology as well, was the conspicuous absence of baldness among these people, for cold draughts of air on heads deprived of Nature's covering are considered by some authors as being a prolific cause of catarrh.

Loewenberg, of Paris, in the *Deutschen medicinischen Wochenschrift*, arrives at the conclusion that ear diseases have a particular predilection for the left ear. He believes that if one ear only is diseased it is more frequently the left. If the affection attack both ears it generally begins in the left, and leads here often to a more profound malady and to a higher degree of deafness than with the right ear. In this respect the sexes differ, in that the predominant deafness of the left side is peculiar to the male, while the reverse is true of female patients. Loewenberg examined 3000 cases of impaired hearing, excluding causes lying in the external ear. Of the whole number there were 1790 males and 1210 females. He found among those affected with one-sided deafness 478 men and 311 women. Of these, the right ear alone was afflicted in 212 men and 167 women, and the left ear alone in 266 men and 144 women. This leaves about 12 per cent. more men afflicted with deafness of the left than of the right side, and about 7 per cent. more women with right-sided than with left-sided deafness.

Among those suffering from bilateral deafness 1074 men and 737 women were found, the right ear being the worse in 427 men and in 340 women, and the left ear having the hearing more impaired in 647 men and in 397 women. There were 238 men and 162 women who were afflicted with a high degree of deafness affecting both ears equally.

B. Alexander Randall has reported 4785 patients with 5412 diseased ears. His table shows only slight variations in the relative frequency of diseases of the right ear as compared with the left, in the sexes. Among both men and women diseases of the right side predominated in middle-ear affections, of the left side in external-ear diseases, and of the right side again in troubles of the internal ear. There is quite a wide difference between the conclusions arrived at from the Paris statistics and the deductions justified by the Philadelphia and Chicago data aggregating 25,785 patients. During the past twelve years the author has taken pains to inquire of patients not only concerning the common causes of their varying diseases of the two ears, but also as to which ear they were in the habit of lying on usually, in order to ascertain if that question could have any bearing on the one-sided character of their diseases or on the fact of one ear being worse affected than the other in bilateral diseases, but no satisfactory solution of this problem has yet been evolved.

This brings us to a consideration of the last topic of this chapter, —climatic causes. In speaking of climatic conditions as standing in a causative relation to these diseases, it should be understood that reference is had to those atmospheric conditions that are characteristic of the vicinity of the Great Lakes and the Mississippi Valley, although they may not be peculiar to it. A sudden great fall of temperature, accompanied with increased humidity of the air, is usually followed by an increase in the number of new patients with acute diseases of the ear, and of chronic cases with acute symptoms. These effects of atmospheric variations occur with such uniformity that we may predict an increase or decrease in the number of acute diseases with a reasonable degree of accuracy by observing the meteorological variations. Our climate is rugged, but the people born and reared in it do not seem to partake of its robust character. The altitude is low in the Mississippi Valley and the thermometric changes are sudden and great. It is not unusual for the thermometer to fall 20° or 30° F. or more in a few hours. Indeed, cold waves sweep suddenly over the country in summer-time, cooling the heated atmosphere so quickly and so thoroughly that one must needs change from summer to winter clothing with haste or suffer from the chilling winds. Add to these causes of great circulatory disturbances the irritating effects of constantly inhaled dust, which the ceaseless winds keep in never-ending motion, and the problem of the prevalence of naso-pharyngeal, tubal, and tympanic catarrh in our climate is, in a great measure, solved.

CHAPTER XXIX.

EXAMINATION OF PATIENTS.

THE examination of patients should be conducted so systematically that no discoverable pathological process can escape detection. Beginning with the right ear, both ears, the nose, and the throat should be minutely inspected. Patients often direct the surgeon's attention to one ear and remark that there is no trouble with the other, when examination reveals that both are affected in different degrees. The examiner should not be misled, but should investigate for himself; otherwise he is not in a position to do credit to himself or his art or do justice to his patron.

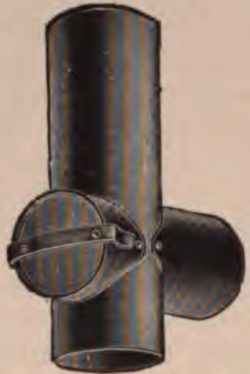


Fig. 109.—The Author's Light-reflector and Screen.

The aurist should sit facing the right side of his patient to begin the examination, with the light immediately behind the patient's head and on a level with his ear if it is an adult. In the case of a child the light should be on a level with the physician's eye.

Time will be economized and labor facilitated by the use of an armless revolving-chair (Fig. 1) for the patient. The seat should be easily raised and lowered by a supporting centre-screw, fitted with sufficient nicety to prevent a rocking motion. The back should be very firm, and only high enough to support the patient's back beneath his shoulders. After examining the right ear neither the physician nor the patient must rise to bring the left ear into the field of vision, for the patient's chair is easily turned half-way around, and the positions are correct to proceed, the lamp then resting in front of the patient.

Excellent illumination is had from an Argand gas-burner, and it is now possible to obtain an incandescent electric lamp that will afford an evenly-diffused light such as the gas gives, but the mantles of the incandescent gas-burners are too easily broken to permit of their being used on adjustable brackets. The flame should be inclosed in a light-condenser (Fig. 109), not only to increase the effectiveness of the illumination, but also to protect the operator's eyes. If the light is allowed to shine in one's eyes it contracts the pupils, interferes with perfect vision, and eventually impairs the sight. The condenser is constructed with a reflector instead of a lens. For this reason it is not top-heavy and requires no spring to hold it in place. By a slight stroke of the finger-nail or a probe, its position can be instantly varied without burning the finger. It fits over the Argand gas-burner or the large railroad-burners on oil-lamps. A special large size is made to fit the incandescent gas-burner.

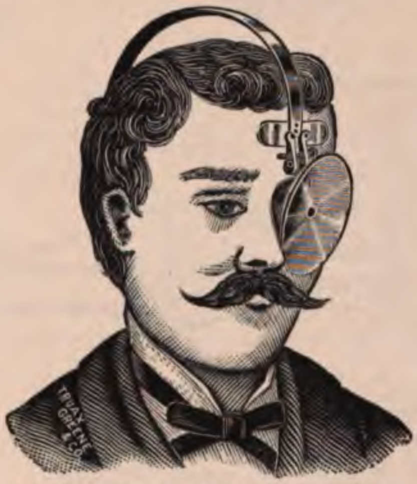


Fig. 110.—Spring-band Mirror-holder.

The three-inch forehead-mirror is worn over the eye that is next to the light, and the aperture in the mirror should fall opposite the pupil of the eye engaged in inspecting the ear, so that both eyes are shielded from the direct rays of light. The light should be thrown in such a manner as to bring the auditory meatus within the focus of the reflected rays. Except at a distance of 14 inches or more, the drumhead is seen with one eye at a time; so that the other eye may be kept closed. The mirror is best held in position by a self-retaining holder, like the spring head-band shown in Fig. 110. This has the advantage of never deteriorating or becoming soiled, and, with properly adjusted spring, it does not occasion the wearer a headache. It leaves the hair unruffled and is in every way more satisfactory than the cloth or rubber bands. The forehead-plate is lined with hard rubber, which renders it agreeable to wear and easy to cleanse.

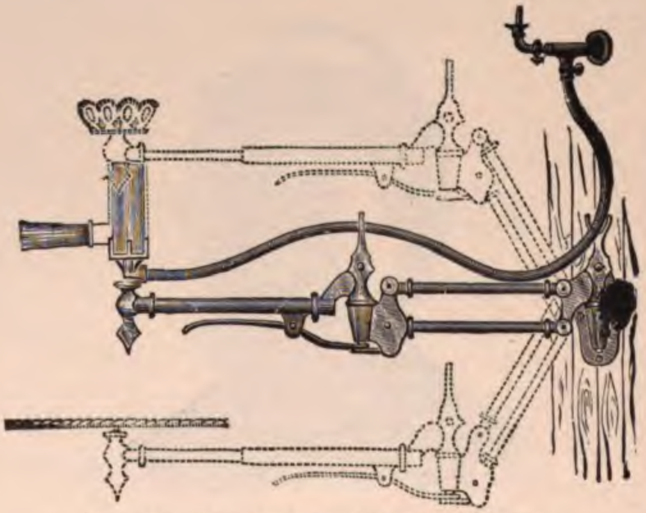


Fig. 111.—The Author's Adjustable Bracket.

The light should be adjustable to the varying positions and heights of patients. To accomplish this the author devised the lamp-bracket illustrated in Fig. 111. The lamp is easily adjustable to any point lying within a perpendicular line two feet in length, and it will swing through the arc of a circle having a radius of three feet. The light may be placed either within a few inches of the surface to which it is attached or at a distance of three feet from the wall. To raise or lower the light it is necessary only to press the brake toward the arm above it, set the lamp at any desired level, release the brake-handle, and it then sets automatically. The gas is carried to the burner through a flexible tube, and where there is no gas an oil-lamp is substituted for the Argand burner.

The metallic ear-specula are preferable to the hard rubber, but they should be warmed, especially in cold weather, before inserting. The small end of the funnel should be oval, to correspond with the contour of the meatus.

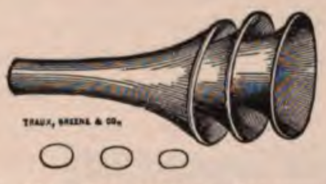


Fig. 112.—The Author's Ear-specula.

The specula represented in Fig. 112 were designed by the writer a considerable time ago, and have been in constant use long enough to demonstrate some decidedly valuable qualities. They are much less cumbrous than the ordinary funnels, and the danger of injuring the drumhead is reduced to the minimum. They are made in three sizes, the smallest being twenty-five millimetres (about one inch) long, and the largest twenty-eight millimetres long (about one and one-eighth inches). The interior is oxidized to prevent the reflection of light into the surgeon's eyes. In order to make them conform to the shape of the auditory canal the distal end is made oval. The funnel end is milled in order to prevent it from slipping from one's fingers, and its shortness and lightness render it less liable to fall from the ear. The cylindrical section bears such a relation to the conical portion as to guard against its insertion far enough to injure the drumhead.

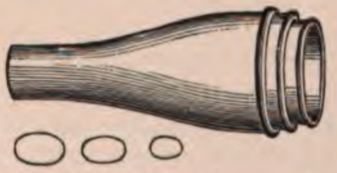


Fig. 113.—Gruber's Ear-specula.

In experimenting with different metals for ear-specula I found aluminum too weak and brittle. It bends out of shape and breaks too easily. The funnels made of brass and plated with silver are the most satisfactory, even preferable to solid silver. They are light and firm. These specula can be inserted far enough to slip within the antihelix, which holds them from falling out of the ear in many cases.

Some of the funnels in use are very much longer than is necessary, and their insertion endangers the integrity of the membrana tympani. There are others that are too heavy and slippery, and they will not remain in position during examinations, treatments, and operations. Others do not conform to the contour of the meatus, being circular throughout. The pigment used to blacken the interior of the funnels in common use is destroyed and removed by the cleansing and disinfecting or sterilizing processes. These specula, being oxidized, can be subjected to the action of strong carbolic-acid solutions, boiling, etc., without injury.

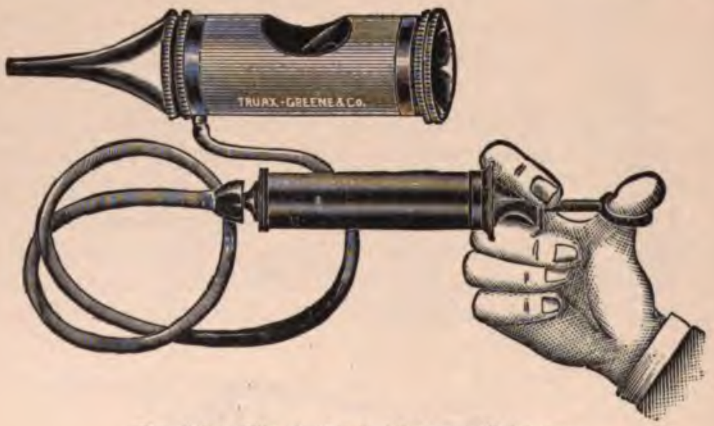


Fig. 114.—The Author's Massage Otoscope.

The auricle needs to be drawn upward, outward, and backward in most cases to straighten the canal while the speculum is introduced, but in children it is sometimes necessary to draw the auricle downward and backward.

A massage otoscope should be employed for diagnostic purposes as well as for treatment. In no other way can it be determined how much mobility of the ossicles has been lost, and how much is regained as the result of treatment. In 1887 the author devised the instrument shown in Fig. 114. It consists of a pneumatic chamber, a concave perforated mirror, and a lens, contained in a cylinder to which is attached forty-six centimetres (eighteen inches) of soft-rubber tubing and a diminutive air-syringe. The apex of the funnel is covered with a section of soft-rubber tubing to allow of its being fitted hermetically into the external auditory canal without causing discomfort. The mirror focuses the light upon the drumhead, and the syringe alternately rarefies and condenses the column of air in the air-chamber and meatus. The lens in the eyepiece gives a clear view of the drumhead and mallet under brilliant illumination and passive motion. By holding the otoscope with the axis of its cylinder at a right angle to the source of light, the rays are projected upon the drumhead. The easiest method is with the operator standing in front and a little to one side of the patient, the otoscope in the left hand for the right ear, and the right hand with the pump on the top of the patient's head. The position is reversed for the left ear. As soon as the light is thrown through the funnel the otoscope must be held steadily in its relation to the lamp, and if the drumhead is not in the field of vision the hand upon the patient's head must tip or turn his head until the drum is brought into view. Now the sight is fixed upon the hammer, while the piston-rod is drawn outward sufficiently to produce an outward excursion of the drumhead. Then it is pushed inward to condense the rarefied air and move the membrane inward. While these movements are being effected it is observed whether the mallet moves with the drumhead or not, and, if it does, how much freedom of movement is present as compared with the normal mobility. In some old cases of sclerosis the mallet remains entirely motionless, while the membrane about it vibrates. In the normal ear both move freely in response to every inward and outward motion of the air-piston. About three hundred of these movements can be made per minute if desired, and the otoscope can be operated either with or without its lens and mirror.

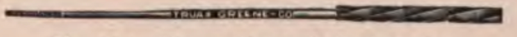


Fig. 115.—The Author's Cotton-carrier.

No more force should be applied than is necessary to obtain the natural excursions of the drumhead and mallet, and ordinarily no discomfort is caused unless the funnel is pressed very firmly against the canal-wall. If a deep blush overspread Shrapnell's membrane and the mallet, the procedure should cease for the time, so as not to occasion too great hyperæmia. The forehead-mirror is not needed with this instrument, since it contains its own mirror. Care must be taken to not allow the fingers to shade the reflector.

The cotton-carrier is best made of soft silver, with round, twisted handle and roughened tip to engage the cotton (Fig. 115).

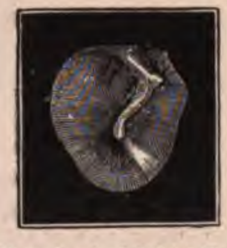


Fig. 116.—Normal Drumhead of Right Ear. (After Politzer.)

It should be very delicate, so as to consume as little space as possible in addition to the cotton twisted upon it. In many instances cerumen or discharges have to be removed before the drumhead can be inspected. The cotton-carrier usually suffices, but the beginner must be reminded that the drum is more superficial in infants than in adults, and in no case should the membrana tympani be bruised.

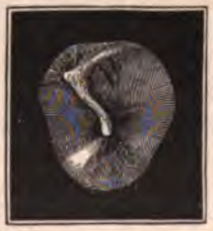


Fig. 117.—Normal Drumhead of Left Ear. (After Politzer.)

The novice ought to accustom himself to the appearance of the normal drum by inspecting patients who have healthy ears. Students may profitably study each other. The healthy drumhead (Figs. 116 and 117 and Plate VIII) has a pearly-blue tint, is translucent, lustrous, and always presents a triangular reflection of light, the apex of which is at the lower extremity of the mallet-handle. This luminous triangle extends downward and forward toward the periphery of the antero-inferior quadrant of the membrane. The long leg of the anvil can often be seen extending downward and backward to articulate with the stirrup, the posterior leg of which is sometimes visible running upward and backward, both together forming a V-shaped figure posteriorly to the upper portion of the hammer-handle. Extending from the short process of the mallet, which is a yellow, dot-like projection of the upper end of the handle, are two nearly horizontal folds stretching forward and backward to the peripheral attachment of the membrane and separating the tense lower section from the membrana flaccida, or Shrapnell's membrane, above (Fig. 118 and Plate VIII).

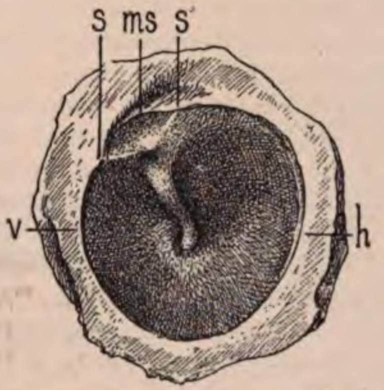


Fig. 118.—Outer Surface of the Left Tympanic Membrane of an Adult, Enlarged Three and One-half Times. (After Politzer.) *v*, Segment of the tympanic membrane lying in front of the handle of the malleus. *h*, Posterior segment of the tympanic membrane. *s*, *s*, Prussak's striæ, passing from the short process of the malleus to the spina tymp. post. et minor. *ms*, Membrana Shrapnelli.

For convenience of description the drumhead is divided into four sections by a projection of the axis of the handle of the mallet to intersect the circumference of the membrane above and below and a horizontal line intersecting the drumhead at its centre. The four segments into which the drumhead is divided by these intersecting lines are called the anterior-superior, anterior-inferior, posterior-superior, and posterior-inferior quadrants, for convenience of description.

Diseased appearances are described in their proper chapters.

TESTS FOR HEARING.

It is difficult ordinarily to test the hearing of one ear in such a manner as to exclude entirely the perception of the test by the other, except in the employment of very delicate sounds, like the ticking of a watch. Even this ticking may be heard by the opposite ear when it is normal. The watch-sounds are the most constant in intensity, the most convenient at hand, and therefore the most universally used. The same side of the same watch should always be employed, since the variations in pitch and volume are great in different watches, and there is sometimes considerable difference in the loudness of the sounds emitted from the opposite sides of the same watch. Many tests should be made with adult persons of normal hearing to fix the average hearing-distance for any test-watch. This distance usually varies from 30 to 60 inches (76 to 152 centimetres), and determines the denominator of the fraction that expresses the hearing-power of any tested ear. The number of inches or centimetres at which the watch is heard gives the numerator. For example: A patient hears my 30-inch (76 centimetres) watch only 10 inches (25 centimetres) with his right ear and only 6 inches (15 centimetres) with his left. We record the watch-test as follows: H. D. R., ${}^{10}/_{30}$ (${}^{25}/_{76}$); H. D. L., ${}^{6}/_{30}$ (${}^{15}/_{76}$); which reads: Hearing-distance for right ear is ${}^{10}/_{30}$, or ${}^{1}/_{3}$ of the normal; for the left ear, ${}^{6}/_{30}$ or ${}^{1}/_{5}$ of the normal distance.

During the test the patient must keep his eyes closed, to eliminate the element of imagination. The watch should always be brought slowly from a distance toward the ear until the patient indicates that he distinctly hears the sound. This process needs to be repeated several times until it is demonstrated beyond doubt that he perceives the sound at the same point repeatedly. While testing an ear the opposite one should be kept closed, unless it is impossible for it to perceive the test.

If the watch is not heard by bone-conduction it is brought into contact with the auricle, and if heard there the hearing is expressed as follows: $\frac{C}{30}$ ($\frac{C}{76}$), meaning contact for the watch. If not heard until pressed against the mouth of the meatus, it is recorded thus: $\frac{Pr}{30}$ ($\frac{Pr}{76}$),—pressure for the watch. In case the watch cannot be heard at all it is written: ${}^{0}/_{30}$ (${}^{0}/_{76}$). In young persons it can be heard by bone-conduction in contact with the mastoid process, upper teeth, forehead, etc., but it is not likely to be perceived from these points of contact by persons over 40 years of age. Great patience is required in testing children's hearing, for they quickly answer in the affirmative whether they hear the test-sound or not, especially when they can see the source of sound.

Tuning-forks are necessary in making a differential diagnosis between diseases of the transmitting and of the receiving apparatus, and in cases where the watch-sounds are not heard. If but one fork is used it is better to employ one of 512 vibrations per second,—the universal standard of pitch. This is C one octave above middle C of the piano. It gives off fewer overtones, or harmonics, if the ends are rounded than if square, and if the vibrations are caused by an automatic hammer attachment (Fig. 119), producing a moderate and unvarying blow. Some are made with sliding clamps to prevent overtones and to raise and lower the pitch.

The fork-test is made by air-conduction similarly to the watch-test. For bone-conduction it is placed with the end of the handle resting on the mastoid, vertex, upper teeth, or forehead, with the shaft at a right angle to the bone-surface. The distance is recorded in terms of inches or metres, and the duration of the perception of sound is taken in seconds. Knowing the average distance and duration for a given fork, the amount of loss or gain in the hearing-power can be quite accurately recorded. Hartmann's set of five forks (Fig. 120) are tuned to 128, 256, 512, 1024, and 2048 vibrations per second. They are the C's of four octaves upward, beginning at the C below middle C of the piano. In the fork-test especial care must be exercised to ascertain that the patient distinguishes between the musical note and the mere concussion or tactile perception of the unmusical vibrations. The latter can be perceived by the fingers as well as by the skull. The percussion-stroke must also be distinguished against.

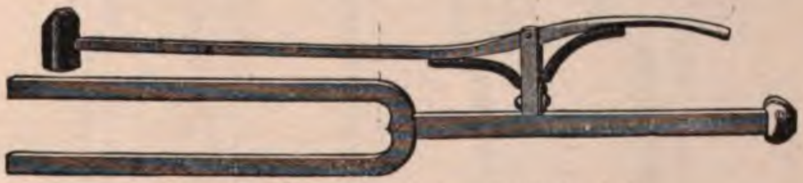


Fig. 119.—The Author's Automatic Tuning-fork.

The fork must not be held with an edge of its branches opposite the meatus; and it should not be brought to the meatus from before backward or from above downward, otherwise the interference of sound-waves in those positions extinguishes the sound.

In making a differential diagnosis between diseases of the conducting mechanism and affections of the perceptive apparatus, the labyrinth, or nervous centres, the following tests are employed:—

Schwabach's Test. — The most important use to which the tuning-forks are put is in making a differential diagnosis between diseases of the conducting, and of the perceptive, apparatus. In case there is an obstruction to the conduction of sound-vibrations through the external auditory canal, or through the middle ear, to the healthy internal ear, it was discovered by Schwabach that a fork vibrating in contact with the cranial bones was heard longer in the affected ear than in the normal ear. The opposite is true when the auditory nerve is diseased; the fork then is heard longer by a normal ear.

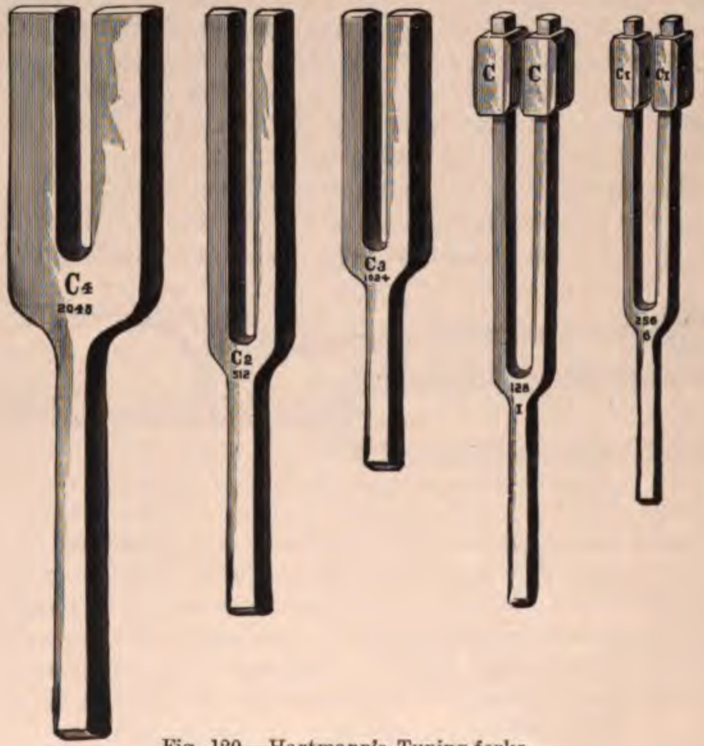


Fig. 120.—Hartmann's Tuning-forks.

If the examiner have normal ears, he compares the patient's perception of sound with his own; or he may compare the perceptions of the patient with the average tests of his standard fork as ascertained with normal ears. By this means the increased or diminished length of time that the patient perceives the musical sounds can be accurately obtained and recorded. For example: The fork is struck and placed quickly upon the patient's mastoid process; the patient indicates the instant that he ceases to perceive the sound; immediately the examiner brings the fork in contact with his own mastoid and notes whether he hears the vibrations after the patient fails to hear them. If so, labyrinthal disease is indicated. If he does not, he sounds the fork again and places it upon his own mastoid process; the instant the examiner ceases to perceive the sound he places the fork in contact with the patient's mastoid. If the latter hears the fork then, after the examiner's normal ear ceases to hear it, an obstruction to the conduction of sound, but not a disease of the auditory nerve, is indicated.

The examiner notes, also, the number of seconds the patient's perception lasts. There are elements of uncertainty and error in this test, for in elderly persons bone-conduction is poor, and when one ear is normal, or when both are unequally affected, the better ear will perceive the sounds and cause confusion.

Rinné's Test.—Air-conduction is superior to bone-conduction normally. The fork is heard before the meatus twice as long as on the mastoid. When the vibrations cease to be heard on the bone, if the fork, yet vibrating, is brought to the mouth of the meatus, it will again be heard by the normal ear (positive Rinné). If the fork is heard longer by bone-conduction (negative Rinné), there is trouble in the canal or middle ear. If the hearing is impaired equally for air- and bone- conduction, there is labyrinthal trouble. Lesion of the transmitting apparatus is shown by (1) gradual loss of perception of both lowest and highest notes; (2) by bone-conduction becoming relatively better than air-conduction. Labyrinthal disease is characterized by (1) no alteration in the relative acuteness of perception of sound by air and bone, both being diminished; (2) by deafness for some tones, generally the higher.

Weber's Test.—In normal ears the fork is heard better when in contact with the skull if the auditory canals are closed. If one ear is closed by the finger the sound is intensified. This phenomenon is probably due to increased resonance of an inclosed space and obstruction to the exit of sound-waves. This has been observed in adhesions, when the middle ear contained fluids, and when the drumhead was relaxed, without closing the mouth of the meatus.

Bing's Test.—After the sound of the tuning-fork vibrating on the median line of the vertex or forehead ceases to be heard, if the external canal is then closed by the finger the sound will be again perceived for a time by the normal ear. If this time is too brief, it indicates trouble in the transmitting apparatus. If this interval of secondary perception is normal, an existing ear disease must be referred to the labyrinth or nervous centres.

Gellé's Test.—The mobility of the stirrup may be determined by condensing the air in the external meatus while the tuning-fork is vibrating on the head. If the stirrup is movable the sound of the fork is heard less distinctly or not at all during condensation, and dizziness or severe vertigo may result. The condensation of the air may be produced by the pneumatic otoscope (Fig. 114) or by a rubber bag with an olive-shaped nozzle.

Galton's Whistle.—This is useful in determining the loss of perception for the highest notes in cases of bilateral ear diseases. If one ear is affected but little or not at all, the whistle-sounds can scarcely be excluded from it. This instrument (Fig. 121) has a compass of about three of the highest octaves, and it is blown by means of a small rubber bulb. The tones can be varied by shortening or lengthening the cylinder by a screw mechanism.

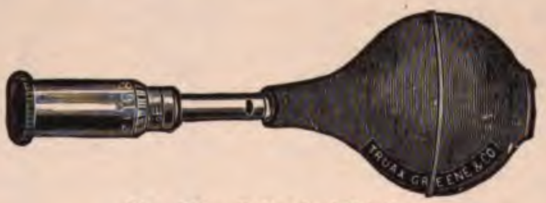


Fig. 121.—Galton's Whistle.

Politzer's Acoumeter.—This is an instrument of precision, which can be heard at a distance of forty-nine feet (fifteen metres) by the normal ear (Fig. 122). It is used very much like the watch directly opposite the opening of the canal, and the hearing-distances are recorded similarly to those of the watch. It is held by the thumb and index finger resting in the semicircular plates, the thumb below, while the percussion-hammer is struck with the second finger. The cylinder which it strikes is tuned to C. To test bone-conduction the metal disc projecting from the perpendicular column is placed in contact with the mastoid process or the temple, while the meatuses are closed. I have observed that in sclerosis a patient may not be able to hear the acoumeter by air-conduction, although he may hear all of Hartmann's forks.

Speech-test.—This would be the ideal test were it not that no two voices are of the same pitch, volume, and timbre or quality. Indeed, the same voice may vary greatly at different times, and even at the same examination. Yet an excellent idea of the amount of usefulness still retained by the organ of hearing can be demonstrated by the speech-test. It is customary to choose words varying greatly in the relative preponderance of vowel and consonant sounds, such as the names of different cities and States, and to request the patient to repeat these words after the examiner. In order to eliminate the possibility of lip-reading the patient is required to keep his eyes closed during the examination. Since there is a tendency to use the same names repeatedly, in which case patients may introduce the uncertain element of guessing, it is better to employ numerals. This gives a much wider range of sounds and lessens the chance of repeating the same sounds in the same order. Whispered speech is also used in addition to the low and loud tones. In advanced sclerosis and labyrinthal affections whispered speech cannot be interpreted.

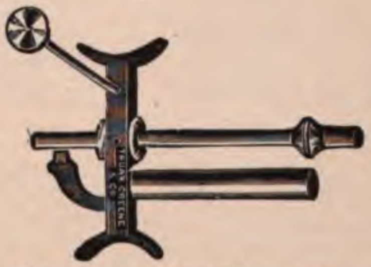


Fig. 122.—Politzer's Acoumeter.

Vowels are heard much farther than consonants, but both should be used in the examination. The test should be made with each ear separately while the opposite one is kept closed. In unilateral deafness a test should be made with both ears sealed with the moist fingers; if then the sound is heard as well as before, it is demonstrated that the sound was perceived by the normal ear.

Music is heard much better than speech. Many persons with greatly impaired hearing, unable to understand a lecture or sermon or the drama, can derive pleasure from an orchestra or opera.

A record of every case ought to be kept in a special form for that purpose. The following one has proven of great practical value in the writer's work:—

S. S. BISHOP'S CASE-RECORD.

Name
Date

Residence
Occupation

Age
Sex
Complaint
Cause

How long affected
Heredity

Colds
Influenza
Hay fever
Nose-bleeding
Sense of smell
Snoring
Sore throat
Diphtheria
Scarlet fever

Measles
Typhoid
Scrofula
Rheumatism
Neuralgia
Lues
Brain disease
Cough
Spitting blood

Hoarseness
Pain
Headache
Night-sweats
Dizziness
Breath
Alcohol
Tobacco
Narcotics

Remarks

Discharge from ear
Subjective noises

Eustachian tubes
Mastoid disease

Rinné test
Weber test

Bing
Gellé

Schwabach
Automatic fork

Diagnosis
Prognosis

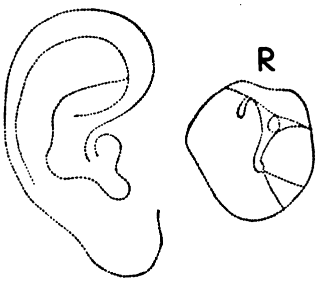
Treatment

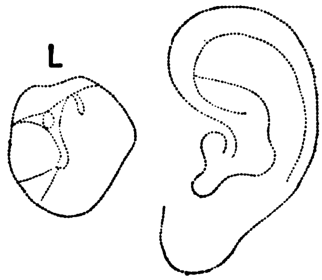
Referred by
Fees

CASE-RECORD.

TESTS FOR HEARING.

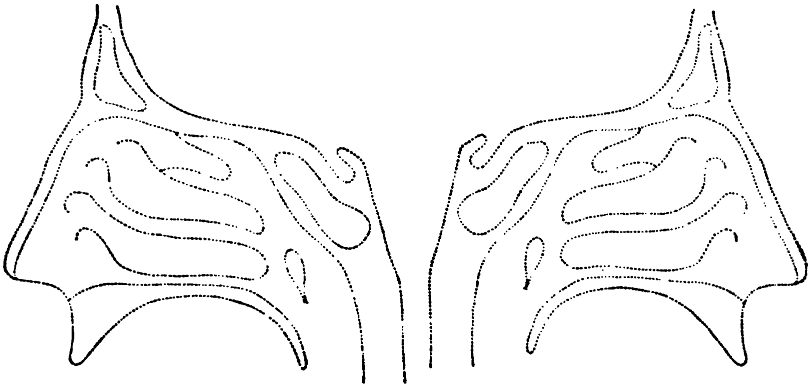
RIGHT EAR.									LEFT EAR.								
DATE.	C 128	C^1 256	C^2 512	C^3 1024	C^4 2048	Acoumeter.	Galton.	Watch.	DATE.	C 128	C^1 256	C^2 512	C^3 1024	C^4 2048	Acoumeter.	Galton.	Watch.

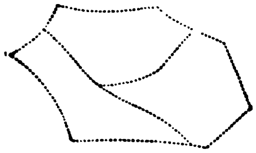


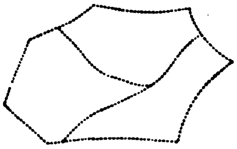


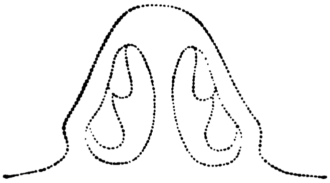
CASE-RECORD.

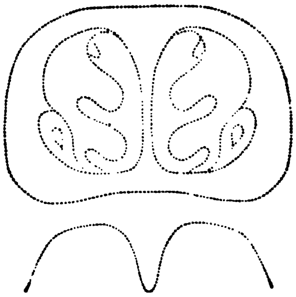
RIGHT. LEFT.







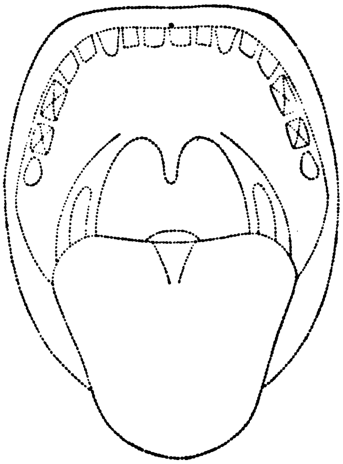




Diagnosis, etc.

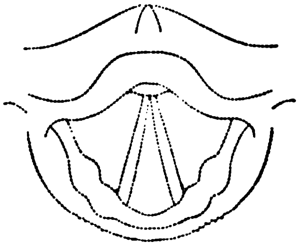
Diagnosis, etc.

CASE-RECORD.



Diagnosis, etc.

History and Treatment.



Diagnosis, etc.

A record of every case ought to be kept in a special form for that purpose. The following one has proven of great practical value in the writer's work:—

S. S. BISHOP'S CASE-RECORD.

Name	Date
Residence	Occupation
Age Sex	Complaint Cause
How long affected	Heredity

Colds
Influenza
Hay fever
Nose-bleeding
Sense of smell
Snoring
Sore throat
Diphtheria
Scarlet fever

Measles
Typhoid
Scrofula
Rheumatism
Neuralgia
Lues
Brain disease
Cough
Spitting blood

Hoarseness
Pain
Headache
Night-sweats
Dizziness
Breath
Alcohol
Tobacco
Narcotics

Remarks

Discharge from ear	Subjective noises
Eustachian tubes	Mastoid disease
Rinné test	Weber test
Bing	Gellé
Schwabach	Automatic fork
Diagnosis	Prognosis

Treatment

Referred by Fees

The force necessary for spraying the nose and throat is not great. Eight pounds will project continuous sprays of watery solutions or lavolin with sufficient force from the Davidson atomizer. About 12 pounds' pressure is needed to produce a continuous and copious lavolin-spray from the De Vilbiss atomizer, and it requires from 30 to 40 pounds to throw a spray of unheated glycerole of tannin.

In adapting the improved compressed-air apparatus to the treatment of the ear the author endeavored to devise some means of determining and controlling the force and volume of air, or the

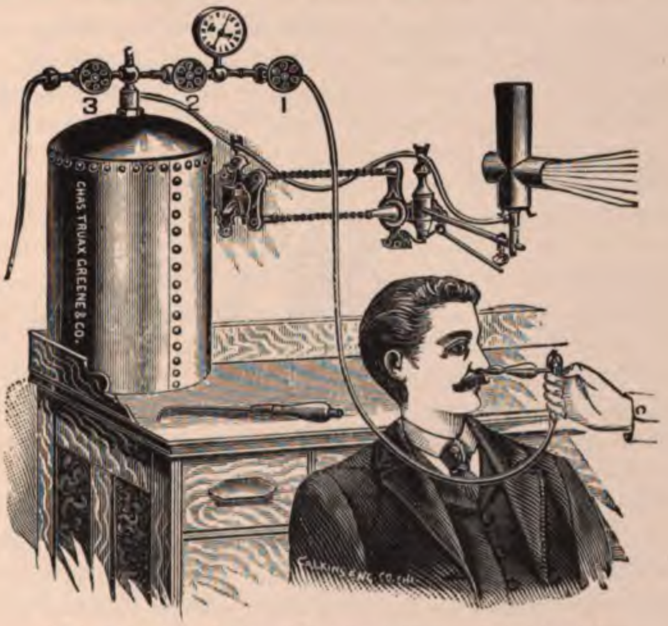


Fig. 123.—The Author's Original Compressed-air Meter.

dosage. As the illustration above (Fig. 123) will show, this has been accomplished by placing a pressure-gauge between two valves on the escape-tube of the air-receiver. This arrangement utilizes the gauge for registering not only the air-pressure in the reservoir, but also the force of the current of air while it is escaping at the cut-off of the treatment-tube. The cut-off that has proven most satisfactory is a modification of the Davidson instrument, to which the writer has added a controlling thumb-screw to hold it continuously open, when desired, to any given extent (Fig. 124).

The meter is used as follows: By opening the outer, right-hand valve marked 1, by turning the wheel to the left one-fourth of its circumference, pressing the thumb-valve of the cut-off, and opening Valve 2, gradually you may obtain any number of pounds' pressure desired at the cut-off,—from 1 up to the full amount of pressure in the reservoir. To use 10 pounds: with the cut-off and Valve 1 open, turn Valve 2 until the index needle runs up to 10. As long as the cut-off remains open, the needle indicates 10 pounds. If you close the cut-off the needle rises to indicate the whole number of pounds in the reservoir. Now, if you fit a spray-producer to the cut-off and open it, the first impulse of the column of air, which is small in volume, is expended in filling the atomizer and starting the spray. In using the nasal bulb of the inflator (Fig. 134) for treating the ear the first impulse is expended in filling the nasal and superior pharyngeal cavities in addition to inflating the middle ear. The volume of air is so small that the needle drops down to 10 at once and remains there as long as the cut-off is kept open. If no more than this amount is desired the cut-off should be opened before the current is turned on and Valve 2 should be slowly opened until the needle indicates the number of pounds required. No greater pressure will then be exerted unless the cut-off valve is closed.

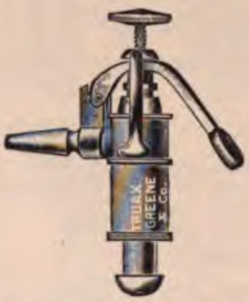


Fig. 124.—The Author's Cut-off.

When it is desired to interrupt the air-current for the purpose of producing movements of the membrana tympani and ossicles, or to throw jets of volatilized medicine or sprays into the tympanic cavity, it is a simple matter to control the pressure in this way. Let us assume that we want to use, with the nasal-tipped inflator adapted to this purpose, 2 atmospheres, or about 30 pounds. Valve 1 being opened, apply the cut-off to the nasal bulb containing the medicine on sponges; open the cut-off; turn on 10 pounds with Wheel 2 and then close the cut-off. The needle rises. Now, if the inflator is inserted into the nostril with the patient's nose firmly closed and cheeks fully distended, the instant the cut-off is opened the needle runs down to 10. Close the cut-off and the needle mounts to 30 pounds. Open the cut-off at that moment and the needle descends again to 10; close the cut-off and the needle rises; the instant it touches the 30 pounds' mark open the cut-off again and so on; repeatedly opening and closing the cut-off will give repeated impulses at any given pressure below that in the reservoir.

The resistance offered by the sponges is small,—less than one-third of an atmosphere.

A little practice will enable anyone to measure the doses skillfully and to give effective treatments without fatigue.

If very rapid interruptions are required, Valve 2 should be opened more freely than in the example given. For 30 pounds' maximum pressure about 20 pounds should be allowed for the uninterrupted current. Experience with this method indicates that not more than 60 interruptions per minute should be made in order to produce perceptible vibratory movements of the drumhead and ossicles.

The dose of air for ear treatment varies greatly in different individuals. While 15 pounds might endanger the continuity of an infant's drumhead or one greatly weakened by disease, or the thin cicatricial membranes closing old perforations, I have often applied 60 or more pounds to old, thickened, and hardened drumheads without rupturing them.

It is evident that, if it require 40 pounds in some cases to propel sprays into the middle ear, it follows that in such instances rubber airbags are insufficient, for they do not average more than from 6 to 15 pounds. But with high pressure only a small volume should be used. I would propose the following rule to keep the operator within the limits of safety: The higher the pressure, the lower the volume should be. If the density of the air is greater than one wishes to use, even with a minute volume, it is easy to avoid the high pressure when using the nasal-tipped inflator by leaving the opposite nostril open during the first impulse until the needle descends to the proper point. This allows the surplus air to escape by the opposite nostril. The same purpose is accomplished with the catheter by holding the catheter-tipped inflator (Fig. 123) a little withdrawn from the mouth of the catheter while the cut-off is first slowly opened. The surplus pressure then escapes at the junction of the inflator and catheter.

The volume should be proportioned to the density with care in cases of atrophied soft palate, so as not to strain the muscles of the thrŏat by too powerful inflations, especially if they are subject to rheumatic sore throat.

It serves a convenient purpose to instruct patients to raise one or both hands every time they feel one or both ears inflated. This obviates the necessity of frequently using the auscultating tube.

The warnings against the danger of rupturing the membrana tympani by politzerization have been freely sounded. The author has never ruptured a drumhead by compressed air, while he has seen a considerable number that were torn or perforated by blows on the ear. Even in men employed in caissons of tunnels, bridges, etc., where they are compelled to work in an atmosphere condensed under a pressure of from 40 to 60 pounds, it is rare to find a ruptured drumhead. This may be due to the fact that they are instructed to inflate the ears so as to equalize the pressure on both sides of the membrane. In this connection it must not be forgotten that there is always the natural atmospheric pressure of nearly 15 pounds on the outer surface of the drum. Notwithstanding this, an eminent otologist has asserted that drumheads have been lacerated by Politzer's method.

Professor Politzer says: "During thirteen years only fourteen cases of ruptured drumheads are known. In the case of a normal membrana tympani a pressure of 45 to 60 pounds is required to cause rupture. In treatment, however, we apply only a pressure of about 8 pounds." If there were any fear of rupture, it could probably be prevented by firmly pressing the tragus into the external meatus.

As compared with the Valsalvan method of autoinflation, the application of medicated nasal-tipped inflators as I have adapted them to the compressed-air apparatus makes an effective topical application of various medicaments possible without any active exertion on the part of the patient. In the Valsalvan experiment there is no medication of the middle ears, but simply a mechanical effect of moderate pressure and a probable congestion resulting from the straining effort. A. Hartman has shown that from 4 to 8 pounds' pressure by the Valsalvan method is required to bulge forward a healthy drumhead. In numerous experiments the pressure averaged from 20 to 26 pounds in males and from 14 to 22 in females; but owing to swelling of the Eustachian tube or contained secretions this experiment often fails.

The unwisdom of advising patients to practice the Valsalvan experiment has often been demonstrated by individuals who have come under my observation with a history of rapid failure of hearing owing to their habit of carrying the aurist's instructions to excess.

Politzer's method is far preferable. He says: "The pressure for the application of my method in practice varies, as a rule, between 15 and 60 pounds."

A decided advantage to both patient and operator, in the adaptation of the inflator to the compressed-air apparatus, lies in the fact that it renders it possible to treat many aural patients without the Eustachian catheter.

The sponges of the inflator may be saturated with solutions of various remedies, and sprays of these medicines can be propelled through the nose and Eustachian tubes into the middle ears with ease and certainty in the majority of cases. This diminishes the danger of syphilitic infection and of irritation of the Eustachian orifices by the catheter.

Gentle pressure will often accomplish this. Indeed, patients sometimes feel a spray enter the ear from an ordinary hand-atomizer, especially when the cheeks are distended. By turning on the current of air gently and gradually increasing it, the permeability of the tube may be re-established by a weak air-pressure more easily than by a sudden, forcible current.

In practicing this method we have usually found the results most satisfactory when the patient assisted by inflating the cheeks and keeping the lips firmly closed. At the instant the closed nasal cavities become filled from the inflator the velum palati and base of the tongue press automatically upward and backward, completely closing the post-nasal space.

When the effort to inflate the middle ears with air or lavolin jets alone fails, it can be made to succeed by placing from 6 to 10 drops of sulphuric ether on the sponges in the inflator. The instant the ether enters the ears there is a decided sensation of coolness, followed by a glow of warmth. The stimulating effect can be seen also in the injected condition of the malleal plexus of vessels soon after the treatment. There are many instances in which the ears are more readily inflated during the act of swallowing.

It has been suggested that these forcible air-currents might convey discharges into the mastoid cells, but Michael has "proved that, especially with the application of strong currents of air, the secretion in the tympanic cavity is always propelled into the external meatus and not into the mastoid process."

Occasionally one sees a case in which the current of air from the nasal-tipped inflator fails to open the Eustachian tube. Probably the anterior lip of the orifice of the tube is pressed by the air more firmly than ever against its fellow, closing it like a valve. A case of tubal stenosis resisted 90 pounds with the nasal bulb, but 50 pounds' pressure carried a spray into his middle ears through the catheter.

Treatment by the catheter is accomplished with the inflators already mentioned, the catheter-tip being substituted for the nasal bulb. The sprays are thrown through the catheter in interrupted jets without imparting painful movements to the catheter, which is well-nigh impossible in the practice of inflation with the airbag fitted with the hard-rubber tube which is inserted directly into the catheter, and without any intervening flexible tube, as the practice is in Vienna.

Proper precaution should be taken to prevent dust from entering the air-reservoir, although by the author's methods all air entering the ears is filtered and medicated.

Finally, these methods make the middle ears nearly as accessible as the nose and throat for treatment with the various volatile remedies and sprays.

CHAPTER XXXI.

METHODS OF PRODUCING AND USING COMPRESSED AIR.

For a considerable time the author has been using a convenient instrument called a vaporizer in connection with the compressed-air receiver, and the results have been so satisfactory that he has introduced it into all of his clinics. This instrument and process of administering aëriform fluids, although used by a few physicians since 1888, appear to be too little employed.

The vaporizer (Fig. 125) is not only different in construction, but also in operation, from the various kinds of spray-producers or nebulizing inhalers. The atomized product projected by it is not properly a spray or a vapor until it expands in the open air. It is so finely comminuted, indeed, that before it leaves the glass container the eye cannot discern it. After its exit from the nozzle it expands into a beautiful floating mass that is comparable to the most delicate undulating cloud. This fine nebula, which is produced and retained until administered under a higher pressure than hand-bulbs afford, may be impregnated with volatile or non-volatile medicaments.

While making some experiments with the vaporizer I discovered that medicines three or four times stronger than patients would tolerate from the ordinary atomizers could be thrown into the respiratory passages, and even into the middle ear, without evoking any disagreeable symptoms. No less pressure than 20 pounds or even more should be employed in order to propel the nebula in sufficient volume and with enough force to dislodge tenacious secretions or crusts, to impress the nebulized remedies on the diseased surfaces, and to dilate the Eustachian tubes, inflate the middle ears, or to open up stenosed bronchioles and occluded air-cells. While a pressure of 20 pounds may be sufficient, no injury has followed the employment of a much higher pressure, as the excess escapes from the lips.

The combined pump and receiver is a very practical, durable, and economical form of apparatus where the pumping must be done by hand, it being comparatively easy to obtain 50 pounds. It is provided with a regulating meter-valve for controlling the pressure by the method described in a paper read by the author before the section on Otology and Laryngology of the American Medical Association at Detroit in 1892. Any spray-producer or inflator can be attached to the cut-off and employed in the usual manner. By attaching the writer's improved cut-off (Fig. 124) to the Globe nebulizer (Fig. 14) and opening the cut-off with the thumb-screw the instrument will operate automatically for a patient to take an inhalation, while the physician is engaged in treating others.

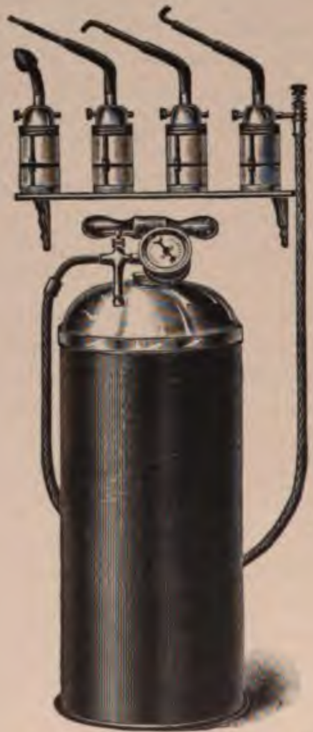


Fig. 125.—Vaporizers and Combined Air-reservoir and Hand-pump.

EAR TREATMENT.

The vaporizer can sometimes be substituted for my improved middle-ear inflator for projecting medicaments into the ear. With the latter we never use a stronger solution of the camphor-menthol than 3 per cent., while with the vaporizer we medicate the tympanic cavity with the 10-per-cent. solution in lavolin without any unpleasant results.

The nozzle is fitted into one nostril, while the other is held tightly closed, as in politzerization. The cheeks are fully distended with air, and the current is turned on from the compressed-air reservoir. The instant the nebula is felt to enter the ear the patient should raise his hand. Then the current is repeatedly interrupted by the cut-off so as to alternately fill the middle ear with the nebula and allow it to escape. This produces not only inflation of the tube and tympanum and motion in the ossicles and drumhead, but it medicates their mucous lining, on the same principle that we observe in medicating the mucous membrane of the eye, or the nose, or throat, when it is diseased. This, combined with the aid of the massage otoscope, provides an ideal treatment for chronic catarrh of the tympanic cavity.

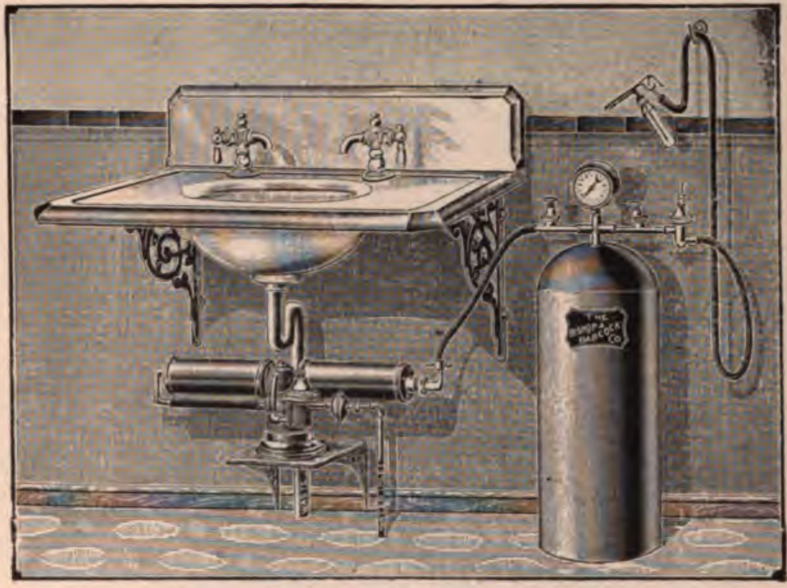


Fig. 126.—Compound Hydraulic Pump Beneath the Water-basin.

When we reflect that middle-ear diseases are largely consequent upon an inflammatory action in the nose or throat, it becomes apparent how necessary it is to employ a thorough medicinal as well as mechanical treatment addressed to this section of the respiratory system; otherwise we cannot hope to effect a permanent improvement.

In connection with the use of compressed air the question of air-pumps is an important one. In a city with waterworks the compound hydraulic pump (Fig. 126) is effective, since it gives about double the amount of pressure obtained by the single-acting pump (Fig. 127). It requires to be cleaned and repaired occasionally, or it fails to afford the required pressure. The maximum of pressure to be had on a ground floor in Chicago, with a compound hydraulic pump, averages from 45 to 55 pounds,—an amount sufficient ordinarily for the aurist, for the air is constantly replenished. In the great modern office buildings, compressed air is supplied to the tenants by means of Westinghouse electric pumps, which are capable of affording any desirable pressure and quantity. In the country the surgeon must be satisfied with the hand-pumps (Figs. 128 and 129), unless he provides an elevated water-reservoir with sufficient head to furnish the

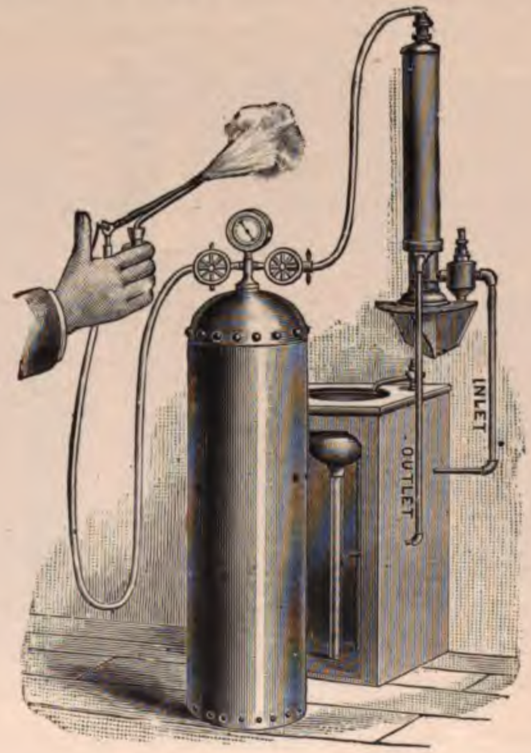


Fig. 127.—Single-acting Hydraulic Pump.

pressure. The combined hand-pump and reservoir made by the Owens Brass and Copper Works, of Chicago, is very convenient (Fig. 125). The pump is contained within the reservoir, which is supplied with an air-gauge, treatment-tube, and cut-off. The whole outfit weighs only fourteen pounds, which makes it conveniently portable.

Another efficient apparatus is manufactured by the Cleveland Faucet Company. It is supplied with a modification of the author's air-meter that registers very accurately the pressure at the will of the operator and keeps it uniformly at any given pressure for which it is set (Fig. 130). Below 30 pounds it operates to a nicety. Pressure above this point can be used nearly to the amount contained in the reservoir, but not with an equal accuracy of regulation. Another excellent modification of the Bishop air-regulator is made by the Globe Nebulizer Company (Fig. 1). In offices and clinic-rooms that are supplied with compressed air from a distant reservoir, the improved meters or regulators can be attached directly to the air-tubes in or upon the walls. In this case it is not necessary for each room

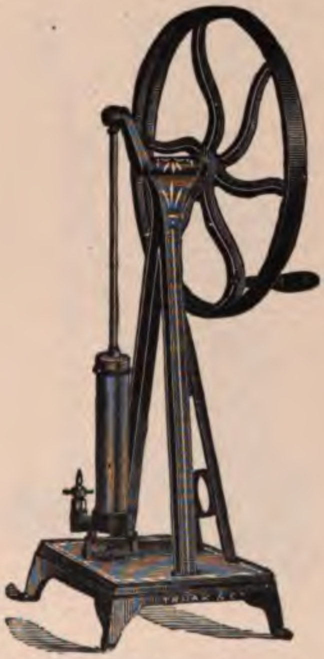


Fig. 128.—Rotary Air-pump.

to have a separate air-tank, for the the amount of pressure at the cut-off is controlled with facility, even when the pressure in the common reservoir is maintained at three or four atmospheres. Regarding all of these apparatus the author speaks from experience in their use.

Politzerization.—The aurist who is not provided with a compressed-air apparatus should possess a Politzer airbag, and it is well to have one at hand to take the place of the air-pump should it fail to work. The Politzer bag (Fig. 133) is fitted with a nasal tip joined to the bag by eight inches of soft-rubber tube. One should also have a Buttle inflator (Fig. 132) fitted with both nasal and catheter tips. In manipulating these the same rule should be observed as in the use of the author's compressed-air inflator (Fig. 134). The axis of the nasal bulb should be parallel to the plane of the floor of the nose. The object is to throw the column of air in the direction of the Eustachian orifice—not toward the nasal duct, through which the air is sometimes forced, nor toward the frontal sinus. The Politzer bag should be grasped with the larger end between the thumb and stronger fingers, so as to be able to exert the greatest force when it is necessary. The rubber tube intervening between the nasal or

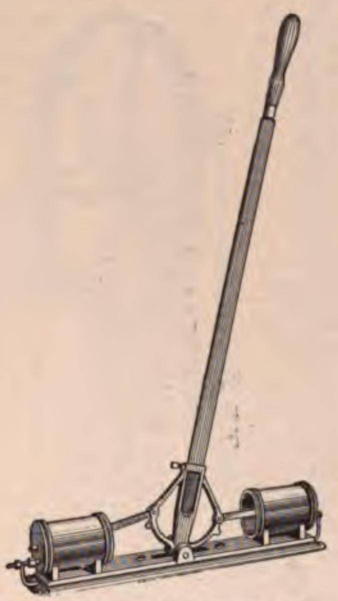


Fig. 129.—Globe Double-cylinder Air-pump.

catheter tip and the bag does not transmit the motion imparted to the bag by the hand and prevents painful jerkings of the tips and the catheter. Especially in the use of the catheter this is an important matter, and may prevent not only injury to the nose, but irritation or contusion of the Eustachian tube. The six- or eight- ounce bags are preferable to the larger sizes. The eight-ounce bag is the most useful for all purposes, and the rubber should be fresh, soft, and of the finest quality.

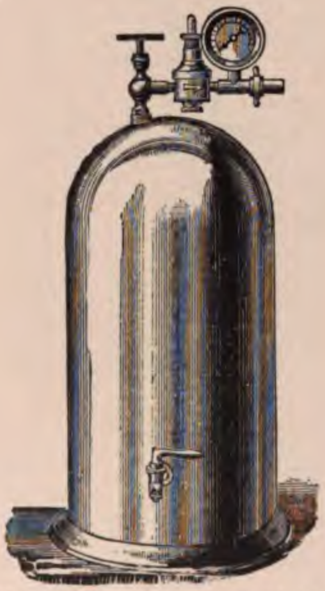


Fig. 130.—Air-meter of Improved Pattern.

Catheterization. — The soft-silver catheters are the best (Fig. 135). They can be easily bent to accommodate any irregularities in the nasal passages or in the vicinity of the Eustachian tubes. There are German-silver catheters in our markets, but Albert H. Buck is very correctly opposed to their use, since they are far inferior to the pure-silver or hard-rubber catheters. It is desirable to have three sizes. As large a calibre as can be introduced without causing discomfort should be employed. To introduce the catheter, the beak of the instrument is placed on the floor of the nose just posteriorly to the skin-lined fossa at the entrance of the naris. At the first step, the handle is depressed so that the convexity of the beak will not hurt the arch of the nasal opening, but as soon as the beak rests on the floor the handle is raised and at the same time carried onward, bringing the main axis of the catheter to a parallel with the floor. As the instrument enters the nose it must not be forgotten that the patient involuntarily moves his head backward. As soon as the beak touches the posterior wall of the pharynx we withdraw the catheter about one-eighth of an inch, rotate it so as to turn the beak outward and slightly upward, and its extremity should now be opposite the orifice of the tube. Then the hand is carried a little toward the median line, so as to bring the beak into the tubal opening (Figs. 27 and 136). With practice one can determine when the catheter rests in the tube by the sense of fixation imparted to the instrument. During this manipulation the ring on the proximal end of the catheter will indicate

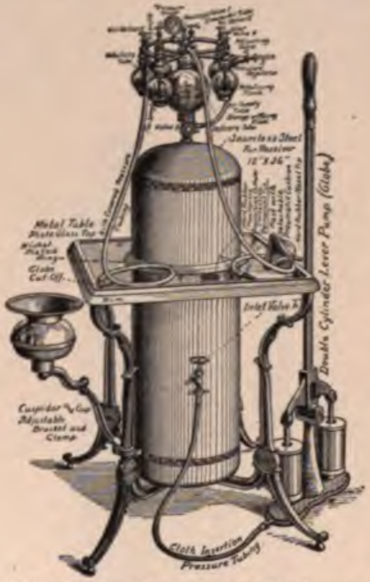


Fig. 131.—Globe Compressed-air Apparatus.

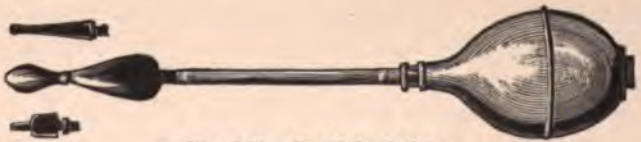


Fig. 132.—Buttle's Inflator.

the position of the concavity or the convexity of the distal extremity. No force need be used. In cases of certain deformities of the inferior turbinated bodies and of the septum the catheter must be rotated through forty-five or ninety degrees, or more, before it can reach the pharynx. With the head thrown backward the weight of the silver catheter is often sufficient to carry it into the pharynx. The introduction can be facilitated by elevating the tip of the nose with the thumb of the left hand while the fingers rest on the bridge of the nose or on the forehead.

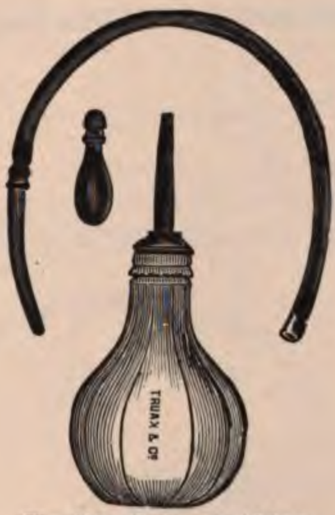


Fig. 133.—Politzer's Airbag.

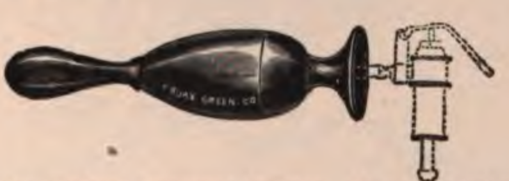


Fig. 134.—The Author's Improved Inflator. It is provided with a tip to fit into the Eustachian catheter.

However, with the improved compressed-air appliances at hand it is not very often necessary to use the catheter except for sclerosis. It is destined to pass out of vogue to some extent, for the reason that air, volatile medicaments, and even fluid-vaselin sprays can be successfully projected into the middle ears by means of the improved inflator (Fig. 134) adapted to the compressed-air apparatus. To the average patient this is a happy culmination of the inventor's efforts, for it averts much discomfort, the possibility of infection and of irritative effects, and incidentally reduces the amount of skill required for treatment. It may be necessary to employ the catheter to inject liquids into the middle ear, or when the inflation must be limited to one ear, but even in the latter case we may generally accomplish this

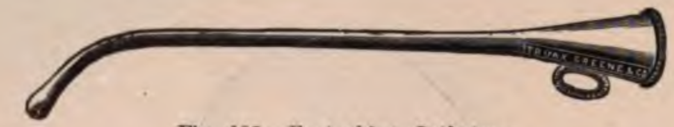


Fig. 135.—Eustachian Catheter.

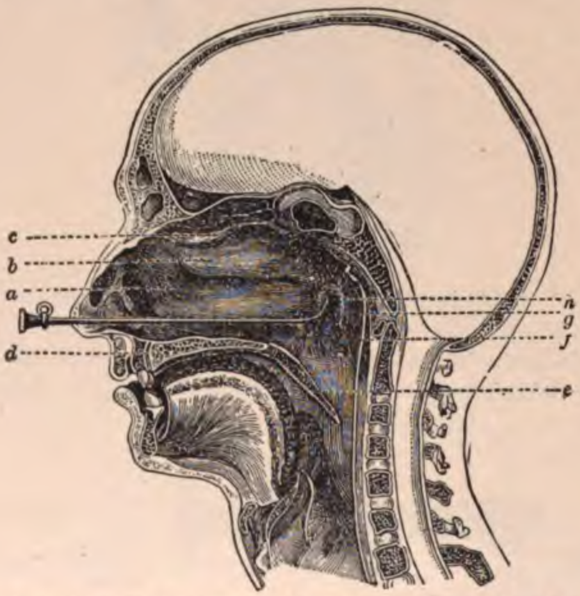


Fig. 136.—Vertical Section of the Naso-pharynx with the Catheter Introduced into the Eustachian Tube. (After Politzer.) *a*, Inferior turbinated bone. *b*, Middle turbinated bone. *c*, Superior turbinated bone. *d*, Hard palate. *e*, Velum palati. *f*, Posterior pharyngeal wall. *g*, Rosenmüller's cavity. *h*, Posterior lip of the orifice of the Eustachian tube. The frontal sinuses are shown above the line *c*.

end with the improved inflator by closing the opposite ear with the patient's finger during inflation. However, we do not desire to be understood as having discarded the use of the catheter after many years of experience with it. In certain cases it is indispensable, but there can be no doubt that the injudicious and unskillful use of this instrument has often been productive of harmful results.

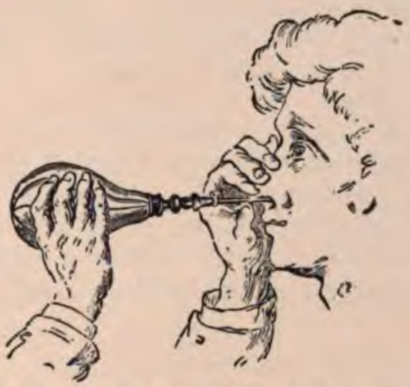


Fig. 137.—Fixation of the Catheter with the Left Hand. Catherization as it is practiced in Vienna. (After Politzer.)

When occasion necessitates the use of the catheter (Fig. 137), the air-pressure must be greatly reduced, for, as Huntington Richards observes: "By it greater power is exerted, and it is more strictly limited to a single ear." If more than 1 or 2 atmospheres (15 to 30 pounds) be used with the catheter-beak not properly adjusted, there is a possibility of forcing the air into the submucous tissues and producing a dangerous emphysema. We have never seen any such results from

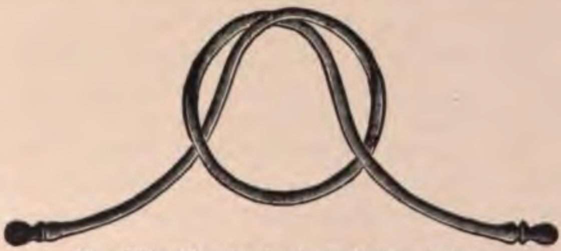


Fig. 138.—Toynbee's Auscultation-tube.

this cause, but three deaths are recorded. Thomas Faith has recently reported to me a case of emphysema of such character, with recovery.

An aid in both diagnosis and treatment lies in Toynbee's auscultation-tube (Fig. 138). One end of the tube should terminate in a white tip and the other in a black one. By inserting the white tip in the operator's ear while the black one rests snugly in the patient's meatus, any sound produced in the ear of the patient is perceived by the surgeon. Thus, when air is forced through the Eustachian tube and impinges against the inner surface of the membrana tympani, the resulting sound is conveyed along the continuous column of air in the patient's external canal, the rubber tube, and the surgeon's auditory meatus to his drum. It is not difficult, then, to distinguish between the free, breezy puff of air through a patulous Eustachian tube and the high-pitched, squeaking sound occasioned by a stenosis.

CHAPTER XXXII.

DISEASES OF THE EXTERNAL EAR.

THE AURICLE.

THERE are certain injuries and diseases of the auricle that are not properly classed as ear affections, the treatment of which is conducted on general principles sufficiently amplified in works on surgery. Such affections and injuries as would not require treatment differing from that demanded by the same conditions in other parts of the body will not greatly encumber our pages.

DISEASES OF THE AURICLE.

Frost-bite.—The symptoms of this condition are so familiar that a description would be superfluous. The chief object to be accomplished is to prevent a sudden disturbance of the circulation in the skin, by insuring a very gradual return to the normal temperature. This is best secured by the application of continuous cold by means of snow inclosed in a handkerchief or by an icebag (Fig. 194) to the auricle after padding the post-auricular space for support. As the crushed ice melts, the temperature of the bag gradually rises until the ice becomes water, and the temperature of the water slowly arrives at the normal bodily temperature. Then the auricle should be dressed with a thick covering of an ointment consisting of equal parts of benzoinated oxide-of-zinc and carbolic-acid ointments. The parts should be protected with gauze or absorbent cotton.

Eczema.—This skin disease is so common and so well described in general works that we may best confine ourselves to the subject of treatment. Eczema is usually associated with a chronic suppurative inflammation of the middle ear, and is a result of that disease. The external canal is likely to be involved at the same time. The acrid, irritating discharges set up the dermatitis wherever they spread, even to the neck, side of the face, and head. So long as these discharges continue to bathe the skin, just so long will the treatment of the eczema prove unavailing. The ear must be so cleansed and kept free from pus, by constant vigilance and the treatment outlined in the chapter on suppuration, that the discharges cease to reach the auricle and surrounding parts. If there are crusts, they are softened and removed by means of Castile soap and warm water. When the surface is thoroughly clean it is covered thickly with benzoinated oxide-of-zinc ointment, which must be strictly fresh and prepared with the purest zinc oxide. This is retained in place by a gauze or fine-linen dressing. In case of great itching or burning the carbolic-acid ointment is added to the zinc ointment in the proportion of one-fourth or one-half carbolic ointment. This acts not only as an antiseptic, but as a grateful local anæsthetic also. Among the most prompt and effective remedies to relieve the pruritus are resinol and epidermol. In obstinate cases a 3-per-cent. salicylic-acid ointment of lanolin has proven rapidly curative, and the same may be said of the yellow-oxide-of-mercury ointment, 5 grains to the ounce of vaselin (1 per cent.).

When the raw-appearing surface rapidly exudes drops of serum, weeping eczema, it should be gently dried by merely touching with absorbent cotton without any friction, and then covered with aristol or nosophen. Prompt drying and cicatrization follow. General treatment may be needed for an impoverished condition of the system, and, if so, Fowler's solution of arsenic is a valuable addition to internal medication.

Lupus. — Lupus vulgaris generally attacks the auricle secondarily to its existence in the face. Yet we have seen it confined to the auricle and external canal, following, like eczema, a chronic suppuration of the middle ear. Brown tubercles, about the size of a pinhead or a small pea, form in the concha, about the mouth of the auditory canal, or in other parts of the auricle. They may be covered with brown crusts or scales. Sometimes they shrink up so as to form cicatrices, which, in turn, may break out later. Lupus exulcerans appears in the form of ulcers covered with brown crusts, underneath which is a spongy, moist, or bleeding surface. Nodules may be seen in the periphery of the ulcers and aid materially in making a certain diagnosis. There is no considerable pain in the early stages, as a rule, nor intense itching as in eczema. The skin is of a darker hue than in the latter disease. A case in my practice, of a lawyer and prominent politician of 60 years, was secondary to a chronic suppuration of the middle ear. After stopping the suppuration the ulcers in the meatus and on the auricle healed under aristol. After three years, however, the disease again attacked the auricle, during a journey in the West, and destroyed it. (Since writing the above he has died.)

All the diseased tissue is best removed by the curette, the galvanocautery, nitrate-of-silver stick, lactic acid, etc., under cocaine anæsthesia, and the wound is dressed with aristol or iodoform and covered with dry iodoform gauze. The results of the x-ray treatment have been so favorable in a considerable number of cases that the patient should be given the benefit of a faithful trial of its efficacy.

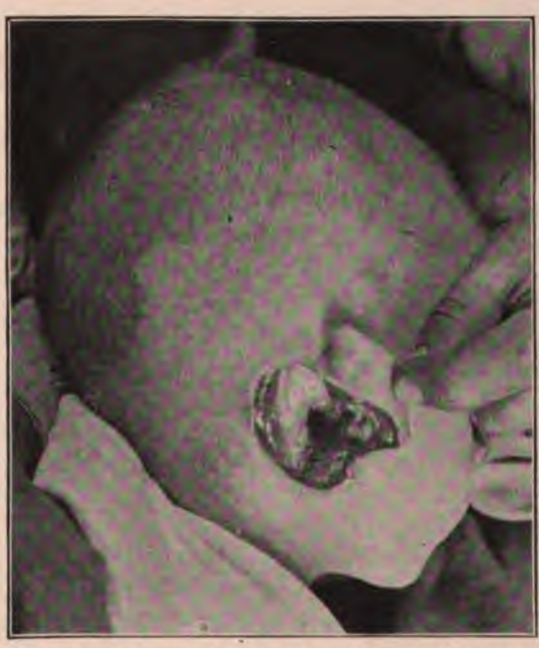


Fig. 139.—Gangrene of the Ear; Mastoid Operation.

The prognosis must be guarded, on account of the strong tendency to recurrence.

Gangrene.—Gangrene of the auricle is a very rare disease. It may arise without any assignable cause; but any condition that vitiates the blood and lowers the vitality and powers of resistance in the presence of a local exciting cause, such as intense cold, pressure, acrid discharges, burns, destructive chemicals, etc., predisposes to this necrotic process. The author has seen one case only. This applied at his clinic at the Illinois Medical College with the following history: A boy, 2 years old, had been an inmate of an orphan-asylum five months. Two months before we saw him a suppuration of the right ear began. Five days before he was admitted to the hospital the skin covering the concha turned black and emitted a foul stench. Both sides of the auricle were necrotic, as well as the adjoining skin of the mastoid process. The necrotic tissue was cut away and the bone was found involved, necessitating a mastoid operation (Fig. 139). After the operation the child, in common with other members of his family, had measles. His brother died, and our patient was attacked with pneumonia, from which he died. The autopsy showed pulmonary tuberculosis.

If gangrene is seen early enough, warmth should be applied to stimulate the circulation until the necrotic tissue separates from the healthy; otherwise operative measures as indicated above are called for.

Carcinoma.—This more frequently arises on the auricle or in the external meatus than in the middle ear or mastoid process. It begins with a sensation of irritation or itching, which the patient increases by persistent efforts to relieve. The development is slow at first and rapid afterward. The irritation is supplanted by ulceration, which, however, is easily distinguished from other similar conditions. While in the lupus exulcerans the ulcer is deep, excoriating, and penetrating, in carcinoma the ulcerating surface is raised above the surrounding tissues, exuberant granulations often projecting to a considerable degree. If the lateral cervical glands become infiltrated the diagnosis is more certain, but they are slow to participate.

The ulceration may extend to the tympanic cavity, labyrinth, and cranial cavity, producing facial paralysis, hæmorrhages, meningitis, brain-abscess, or thrombosis, and, after great suffering, death. The treatment consists in complete extirpation of the diseased tissue when possible, the knife penetrating beyond the disease into the surrounding healthy tissue. If the auricle is extensively involved it should be amputated, and if the cervical glands are affected they must be excised at the same time. Should it be necessary to invade the external meatus, a plastic operation may possibly preserve its patency, which is important on account of the hearing. After-treatment is the same as for lupus. For treatment with alcoholic injections see treatment of carcinoma of the pharynx.

Perichondritis.—This is not a frequent disease, but early treatment is important to prevent deformity. In the early stage there occurs a swelling of a part or the whole of the auricle, with a dusky-red surface, accompanied by heat and pain. We have seen the auricle increased to an enormous size by the effusion of a syrup-like fluid between the cartilage and the perichondrium.

Treatment consists first in the application of cold by means of an icebag (Fig. 194). If there is great swelling with fluctuation it must be incised, the fluid pressed out, and the cavity irrigated with antiseptic solutions. We have obtained the best results from injecting equal parts of tincture of iodine and water or alcohol, and applying pressure with cotton and a bandage.

Hæmatoma.—Othæmatoma is an effusion of blood between the cartilage and the perichondrium. It rarely arises spontaneously, but is generally the result of traumatism. It occurs suddenly after a blow on the ear or pulling the auricle. It is a rather frequent occurrence in the mentally defective, and possibly indicates a disease of the base of the brain. Brown-Séquard has shown that section of the restiform body in animals is followed by this disease. The appearance of the tumor is accompanied by heat and pain. It nearly always occupies the anterior aspect of the auricle, and may cover a large portion of that surface. The natural outlines are obliterated, and in their place is a fluctuating, pale, bulging tumor. It may rupture spontaneously or suppurate, or in rare instances it disappears. During the first, or inflammatory, stage, when there are heat and pain, the constant application of cold is indicated (Fig. 194). If an icebag is not obtainable, a bladder can be filled with ice or snow as a substitute. If the swelling does not diminish, it must be incised, in one of the natural folds to prevent disfiguration, and emptied of its contents. Most satisfactory results have followed washing out the cavity with a 5-per-cent. aqueous solution of carbolic acid, insufflating with aristol, and binding it with an absorbent-cotton compress. Randall opens the sac, curettes it, rubs with iodine glycerite, packs with iodoform gauze, and covers it with a pressure bandage.

In this connection it is our duty to condemn in the strongest terms the brutal practice of pulling and boxing the ears of children indulged in by ignorant parents and teachers. The author has seen many cases of deformities, ruptured drumheads, abscesses, and deafness resulting from this inhuman habit.

Cystoma.—Cystoma is a tumefaction usually found on the anterior aspect of the auricle. Its appearance is similar to the blood-tumor already described, but it contains, instead of blood, a serous fluid, which is sometimes of a syrupy consistence and appearance. It arises suddenly from an unknown cause, without a previous injury or inflammation. The treatment is the same as for hæmatoma,—incision, etc.

Intertrigo.—An excoriated condition of the skin on the adjoining surfaces of the auricle and mastoid process is of frequent occurrence among children of the poor. It may be due to an impoverished condition of the blood, but is more likely to be caused by uncleanliness and the harmful habit of binding the ears down against the head by close-fitting caps. The skin denuded of its cuticle presents a red, raw, moist appearance, but it is smooth and without thickening, in this respect differing from eczema, which may be ingrafted upon it. The trouble is aggravated by the efforts of the child to relieve the intense itching by scratching. The treatment is similar to that for eczema, except that dry applications are indicated, as in the weeping form of eczema. Powders are preferable, and of these aristol is sufficient. The binding caps must be interdicted and the irritated surfaces kept apart.

Miscellaneous.—Herpes, pemphigus, and syphilis of the auricle are very infrequent lesions that differ in no way from the same affections of other parts of the cutaneous system and require no different treatment. Not being diseases peculiar to the ear, their description will be omitted here.

DEFORMITIES OF THE AURICLE.

Arrested and excessive development of the auricle in relation to degeneration have been made the subject of extensive investigation by E. S. Talbot, of Chicago; Spitzka, and others; but the discussion of this phase of the subject lies beyond the province of this book. Talbot's illustrated article, from which Fig. 140 is taken, appeared in the *Journal of the American Medical Association* for January 11, 1896.

Auricular deformities may be divided for convenience into congenital and acquired. Congenital deformities may be classified as correctible and irremediable. Acquired deformities fall under two headings: those resulting from disease and those from injuries.

Hypertrophied Auricle.—The most common defect is the large, flattened, wing-like ear that stands out conspicuously from the side of the head (Fig. 140). This ear-mark serves as a butt of jest for the child's companions, and makes life a burden to the bearer. Its exaggerated prominence suggests its prototype among the lower animals, the mule-ear. The natural surface inequalities are diminished, the border of the helix is often thin and expanded, and the whole flaring pinna appears as if it had been subjected to constant pulling or pressure.

While a large percentage of these cases are congenital, that barbarous mode of petty punishment—pulling the ears—may account for a certain amount of this deformity. We have been led to this conclusion by information elicited in many instances. The pressure produced by the tight caps so much in vogue with some people may be a factor.

The treatment is operative. The author has proceeded in two ways: by reducing the actual size of the auricle, and by effecting a corrective amount of adhesion between the auricle and the mastoid process. The first operation is done by removing an elliptical section of the cartilaginous framework and the corresponding integument on the posterior surface and bringing the edges of the wound together with sutures including the cartilage. The long diameter of the ellipse is, of course, vertical. The cartilage must be dissected out without penetrating the skin of the anterior surface. By making accurate measurements and marking the size and shape of the section to be removed, the result will be satisfactory. The auricle is then to be dressed with aristol, antiseptic gauze, and the net bandage. This bandage is made of white mosquito-netting, moistened through just before applying, and it dries in place somewhat like the plaster bandage. Union by first intention is had and the stitches are removed as soon as the adhesion is firm. This method is superior to the removal

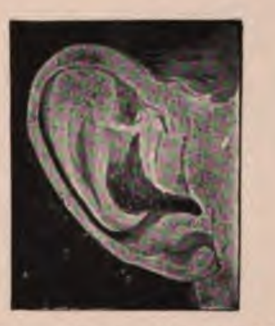


Fig. 140.—Hypertrophied Auricle.

of the skin alone, in which case the resilience of the cartilage tends to tear out the sutures or bulge forward the anterior surface unduly.

The second method is easier to practice, and I have given it preference for a number of years. The auricle is pressed against the side of the head in such a way as to give it in every part a little less projection than it ought to have. Now the line of junction is marked throughout its whole extent on both auricle and head. The section of skin included within these lines is dissected out in a thin layer so as to leave a denuded surface; the edges of the wound are approximated and sutured with the stitches close together and penetrating the subcutaneous tissues. The dressing and subsequent treatment are the same as after the first operation.

This corrects a most unsightly deformity and may result in a beneficial influence on the temper and happiness of the patient for the remainder of his life. So far as we have been able to learn, this method of operating had not been practiced previously to its introduction by the author.

Scroll-ear and Associated Deformities.—There is a deformity of the auricle in which the border of the helix turns forward and downward in a scroll-like roll. In such cases as I have seen the auricle is diminutive in size and does not present favorable conditions for an operation. In certain instances this condition amounts almost to obliteration of the pinna, and the auditory canal is absent. To illustrate, we will cite one of the cases reported by the writer to the Tenth International Medical Congress, held in Berlin:—

A girl, 8 weeks old, was brought to my clinic October 10, 1885. There was a congenital deformity of one auricle and absence of the external auditory meatus of the same ear. The auricle was rudimentary and doubled forward upon itself. It appeared shrunken and pinched, and had a large, hard nodule and several indentations in that part of the helix that corresponds to the keystone of an arch.

It is interesting to note, in this connection, that the mother attributed the deformity of the auricle to the fact that, about the fifth month of gestation, her elder child bit the mother's ear severely, at just that point that corresponds to the greatest auricular deformity in the baby.

At the point where the canal ought to have been there was a depression or *cul-de-sac* that yielded to pressure, and imparted to the touch an impression as if there were an opening in the bone beneath.

Four months later careful tests led us to believe that the child could hear with that ear. I operated to correct, as far as possible, the deformity of the auricle, and to ascertain if there were any bony meatus. On cutting down into the *cul-de-sac* where the canal should have been, we found nothing but a depression in the bone. No bony canal could be found, and it did not appear that further operative interference would be justifiable. However, a sufficient opening was maintained to give quite a respectable appearance of an external meatus.

Virchow's *Archives* says: "Congenital anomalies of the external ear and its neighborhood are to be referred to early disturbances in the closure of the first branchial cleft, and are often associated with fistulæ of the other branchial clefts, cleft palate, and other forms of arrest of development in the facial bones,—as, for instance, with unilateral atrophy of the face."

Certain acquired deformities have already been noticed in connection with the diseases that produce them,—perichondritis, etc. Treatment can hardly avail to remedy them. Those resulting from injuries must be treated on general surgical principles, with care to prevent any closure of the auditory canal. The latter subject will be presented in the following chapter.

CHAPTER XXXIII.

DISEASES OF THE EXTERNAL AUDITORY CANAL.

Inspissated and Impacted Cerumen.

Impacted wax is a common condition that may give rise to serious results. It is really a symptom of disease, and often is provocative of other pathological manifestations. Recurring hyperæmia or eczema of the external canal may excite the ceruminous glands to hypersecretion, and anomalies of the canal may prevent the natural process of elimination of the cerumen; so that for these two reasons it becomes dried and impacted. With the movements of the lower jaw, corresponding motion is imparted to the cartilaginous portion of the canal, which has the effect of working the accumulations of wax outward; but, when the mouth of the canal is very narrow and when exostosis or other mechanical obstructions occur, they prevent the outward movement of the secretion, and it stops up the canal effectually. Patients often contribute to this impacting process by their efforts to cleanse the canal with towels, etc., at the bath. The middle ear may not be involved in the diseased process, or both parts may participate in trophoneurotic changes due to central causes. There may be, moreover, a simple desquamative inflammation with an abundant exfoliation of the epidermis. In these cases the ceruminous plugs consist of the fatty secretion, epithelial scales, hairs, etc., which are often horn-like in their hardness.

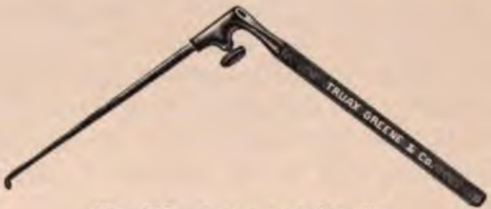


Fig. 141.—Lever and Handle.

Symptomatology.—The hearing may not be perceptibly diminished, providing the remainder of the ear is in its integrity and the plug does not completely fill the lumen of the canal; but sudden impairment of hearing and a stuffy sensation in the ear, with confusion, may supervene directly after a bath or profuse perspiring, occasioned by absorption of moisture and swelling in the plug. On the other hand, there is a gradual diminution of the hearing-power going on, which is scarcely observed by the patient until his friends call attention to it. Tinnitus aurium often occurs, and, with complete blocking of the canal, intense subjective noises; autophony, or a hollow sound of one's own voice; neuralgia of the ear or of the temporal and supraorbital regions; numbness about the ear and side of the face, reflex cough of a spasmodic character, and mental dullness. Children are often chided for inattention or inaptitude when they are the unfortunate victims of such an ear disease. In the latter case both ears will probably be found to be affected. Impacted cerumen gives rise to even more serious symptoms, for the plug, which is, in effect, a foreign body, may work inward until it impinges upon the drumhead, causing perforation or intralabyrinthal pressure, vertigo, and epileptiform seizures. After a suppuration of the middle ear has ceased we have found these large plugs blocking the exit for pus when a fresh cold has set up another suppurative inflammation. In such cases the pus may burrow inward and fill the mastoid cells, and even seek the cranial cavity before it can dislodge or penetrate these stone-like plugs. Their presence sometimes is sufficient to cause absorption of the canal-walls and an immense increase in the size of the canal. After their removal the skin beneath is often inflamed and appears more like mucous membrane than healthy integument.

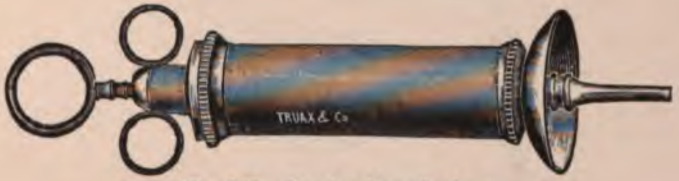


Fig. 142.—Hard-rubber Syringe.

Diagnosis. — The diagnosis is easily made on inspection of the canal, for the dark-brown or black mass is plainly visible, obstructing a view of the drumhead.

Prognosis.—The prognosis depends upon the condition of the middle ear and labyrinth. If they are healthy the hearing will be restored and the subjective symptoms removed upon the extraction of the cerumen.

Treatment.—The treatment consists (1) in the complete removal of the plug and (2) in remedies addressed to any pathological condition revealed by its extraction. If one is adept in the manipulation of ear instruments he can dextrously pull out the plug with the lever (Fig. 141) found among the middle-ear instruments (Fig. 181). It should be passed into the canal with the lever horizontal, next the roof, and carried far enough so that when the lever is turned downward it will imbed itself in the cerumen. The latter may be so hard that quite a considerable pressure must be exerted to penetrate it, or it may be so soft that only a part, instead of the whole plug, will glide out with the lever when traction is exerted. Care should be taken not to touch the drumhead or produce any abrasion of the canal-wall with the lever. Those who are not practiced in ear-work had far better use the syringe. The continuous-flow rubber syringe with hand-bulb to regulate the pressure is the best. The glass syringes usually sold under the name of ear-syringes are of no account whatever for this purpose. The hard-rubber piston syringe (Fig. 142) is made for the ear with a flange to prevent its being introduced too far, but patients are likely to insert the nozzle so far that the flange stops up the canal opening, thus forcing the plug farther inward, or, when the plug is out, exerting undue pressure on the drum-membrane or even rupturing it. The Davidson alpha or omega syringe (Fig. 143) has proved even more effective than the fountain-irrigator. The stream should be thrown so as to enter any space that may be seen between the canal-wall and the cerumen, rather than against the centre of the plug. As much force should be employed as the patient can bear with comfort, and without producing dizziness. The water must be as

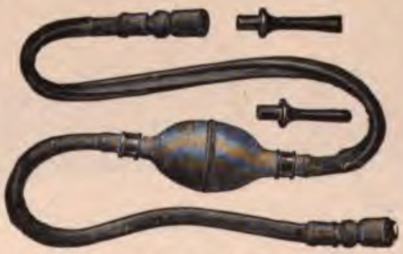


Fig. 143.—Alpha Syringe.

warm as can be easily borne, and a quart or more may be necessary at a sitting. The emulsifying and disintegration of the ceruminous mass can be much facilitated by preceding the use of the syringe with an instillation of hydrogen dioxide or a 4-per-cent. solution of bicarbonate of sodium in glycerin and water, equal parts. The ear should be filled with this fluid warmed, several times during the day, allowing it to remain a quarter of an hour; then the mass breaks up readily and washes out with the injections. The canal should afterward be dried, smeared with warm vaselin, and protected for a few days with clean cotton. Any dermatitis should be treated according to the principles laid down under the following heading.

DIFFUSE INFLAMMATION OF THE EXTERNAL MEATUS.

Diffuse inflammation may be acute or chronic in character and may include the whole extent of the canal, although it is usually confined either to the osseous or to the cartilaginous portion. In my experience it more often has affected only that part of the meatus that adjoins the drum-membrane, and frequently it was limited to the superior half of the canal and invaded the membrana flaccida.

Pathology.—If seen early the canal-wall presents a bright-red and smooth aspect. When the inflammation becomes intense and infiltration of the integument causes it to swell, the lumen of the canal is so encroached upon as to make an examination of the drum-membrane difficult or impossible. The walls then lie in contact and even press upon each other; so that introduction of the smallest funnel is impracticable. When the membrana tympani is involved and can be seen, it may look red and swollen and the hammer-handle may be wholly invisible. A white coating of epidermis is frequently found lying loosely in the canal, and can be easily detached and removed in casts. In an advanced stage ulceration and granulations are found.

Etiology.—The common habit of working at the ears with ear-spoons, hair-pins, common pins, matches, and other hard substances is a prolific cause of inflammation of the canal. Instilling oil that becomes rancid, foreign bodies, and vegetable parasites act as exciting causes.

Symptomatology.—In the first stage, or hyperæmia, there may be no pain or impairment of function, and the patient remains unconscious of any unusual condition except for the itching. His attempts to relieve this only serve to increase the irritation, and, as the disease progresses, pain of a severe character is developed. The movements of the jaw and pressure about the ear aggravate the pain. With the occurrence of profuse transudation the hearing is dulled, and tinnitus and even vertigo may ensue. The more copious the exudation, the greater the stenosis and impairment of hearing. In very old cases the canal is found full of an offensive, thick, and greasy secretion.

Diagnosis.—The diagnosis is not easy to make when the stenosis is great. It may be impossible to differentiate between an affection of the canal alone and one affecting both the canal and middle ear. A microscopical examination of the exfoliated epidermis for micrococci and vegetable fungi may clear up the diagnosis.

Prognosis.—This depends upon the extent of the inflammatory process. It may invade the tympanic cavity and produce suppuration. It may extend to the bony walls and even to the mastoid cells and cranial cavity, but such results are rare. The lumen of the meatus may be permanently contracted or obstructed by adhesive processes. But the usual course under proper treatment is favorable.

Treatment.—If the inflammation is very active and painful and the stenosis complete, an icebag (Fig. 194) should be applied. Abstraction of blood by leeches may give relief, two being applied in front of the tragus. If the canal is sufficiently open to permit of washing it out, a 3-per-cent. hot solution of carbolic acid should be used until the canal is thoroughly cleansed. Then it should be dried with cotton without friction, and covered with a coating of aristol by means of a small powder-blower (Fig. 144). If this does not stop the secretion in a few days, nosophen or the fine boric powder should be substituted.

FURUNCULOSIS.

Synonyms.—Furuncle; boil; follicular or circumscribed inflammation of the external meatus.

Pathology.—Furuncles are generally limited to the cartilaginous portion, and most frequently to the posterior or anterior wall of the auditory canal. Although they may be secondary to a middle-ear inflammation, they are frequently idiopathic in character. Furuncles appear singly, in groups, or in successive crops, and probably are due to the staphylococcus pyogenes aureus and albus entering the hair-follicle or sebaceous gland, or to some trophic change in the nervous supply of the meatus.

Etiology. — Any irritation of the canal predisposes to furuncle: foreign bodies, irritating instillations, ear-spoons, matches, discharges from the tympanic cavity, too frequent syringing, and vegetable parasites. The same may be said of a general impairment of health, diabetes, anæmia, and dyspepsia.

Symptomatology. — The onset of the attack is attended with a sense of fullness or itching, followed by tenderness on touch, pains of a throbbing character, and, as the swelling increases, impaired hearing and subjective noises. The pain becomes intense for a day or two and subsides on the rupturing of the boil. Movements of the jaw increase the pain to such an extent that mastication is out of the question. When the furuncle is located on the anterior wall, the tragus may become red, swollen, prominent, and sensitive; when it is on the back wall, the swelling may be sufficient to protrude the auricle and simulate the appearance of mastoid periostitis. Occasionally the cervical glands, and the lymphatic glands over the mastoid process, when they are present, become infiltrated. For the first two or three days the fever, headache, and furred tongue denote a general systemic disturbance.

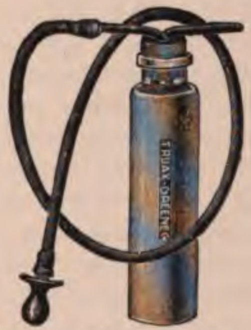


Fig. 144.—The Author's Small Powder-blower for the Ear. It can also be operated by a small rubber bulb.

Diagnosis.—This is not difficult on careful inspection with brilliant illumination. This disease is not likely to be confounded with any other, when we consider the prominent symptoms. The boils are easily detected with the probe.

Prognosis.—The disease usually runs its course in about a week, and unless successive crops occur, or unless the general health is impaired, the trouble is over. But it should not be forgotten that in certain instances the inflammation has invaded the tympanum, the mastoid, and even the cranial cavity.

Treatment.—The first indication is to allay pain, if there be any, for which bromidia internally and cocaine locally are effective, the former in teaspoonful doses in water every half-hour or hour for an adult until pain ceases, and the latter in a very warm, 10-per-cent. solution. As soon as the pain is relieved we should cleanse the meatus with hydrozone (dioxide of hydrogen, or peroxide) comfortably warm. It can be warmed to a little above blood-heat (105° F.) without impairing its effectiveness. Its effervescent action washes out the canal, and its bactericidal property strikes at the root of the trouble. After cleansing, a 20-per-cent. solution of camphor-menthol on cotton exerts a comforting and curative influence. It is to some degree a local anæsthetic, antiseptic, and a constrictor of the capillary blood-vessels. A 12-per-cent. solution of carbolic acid in glycerin acts similarly. They are applied, like the cocaine, on a cotton tampon. As soon as a point of distinct fluctuation can be made out, it should be incised deeply through the centre, under cocaine, and pressure exerted about the base to express all pus or necrotic tissue. After once thoroughly cleansing the canal, it is important to keep the skin as dry as possible in and around the meatus, on the same principle that guides us in the treatment of suppuration of the middle ear. Thomas Barr has obtained marked benefit from the ointment containing 4 grains of iodoform or boric acid, and 2 grains of menthol in a drachm of vaselin. This is smeared on cotton pledgets and placed so as to produce a little pressure on the boil, but the plugs should be changed as often as an accumulation of the discharge requires.

Subsequent treatment consists in the application of a small amount of yellow-oxide-of-mercury ointment, 5 grains to the ounce; salicylic-acid ointment, 3 per cent.; or carbolic-acid ointment. Proper treatment is addressed to the general health. Sulphide of calcium is credited with the power of aborting or modifying the disease.

PARASITIC INFLAMMATION OF THE EXTERNAL MEATUS.

Synonyms.—Mycosis; otomycosis; mycomyringitis; aspergillus; myringitis parasitica; ear-mold; aural fungi.

Pathology. — Vegetable parasites in large variety are found in the auditory canal, but it is beyond the scope of this work to give a detailed description of the microscopical appearances of these fungi.

For an extended study of this subject the reader is referred to Burnett's exhaustive work. The most frequent varieties are the dark-brown aspergillus, or nigricans; the yellow, or flavescens; the green, or glaucus; and the grayish black, or fumigatis. When these parasites once find lodgment in the ear they multiply rapidly. This usually begins upon the drumhead, and the growth and the resulting inflammation extend outward until the whole meatus may be involved. These cases are not often seen until they are so far advanced that the condition is generally one of complete covering of the drum-membrane and meatus with the mold. On removing the growth, which I have peeled out in a complete cast of the canal, the skin is red and raw in appearance, as though robbed of its epidermis.

Etiology.—A damp atmosphere favors the growth of these parasites. The middle-aged and poor are the most frequently attacked. The common use of oils by the laity predisposes to this disease, as does any decomposing secretion or substance in the ear.

Symptomatology.—Ear-mold may exist for a long time without the patient becoming aware of its presence, but when an active inflammation supervenes decisive symptoms develop. At first there is only an itching or irritation or feeling of fullness, followed by pain, subjective noises, and diminished hearing. In my experience there is rarely a discharge except when the disease is secondary to a suppuration of the tympanic cavity; but if the inflammatory action is severe a serous exudation occurs. Inspection shows in the black variety what is easily mistaken for a long-standing plug of inspissated cerumen were it not that the surface of the obstruction has a velvety or coal-dust appearance. In case of the yellow aspergillus, the parts look as though they had been sprinkled with finely powdered mustard or yellow pollen. On removing the false membrane formed by the mold, its surface next to the skin is of a dirty, grayish-white color. I have found this growth ingrafted on ceruminous plugs which required considerable time and care in removing. After their removal there was revealed not only the characteristic inflammatory condition, but an enormous distension of the meatus, due to pressure and the absorption of the canal-walls.

Diagnosis.—Having in mind the appearances described, the diagnosis is not difficult under good illumination, but a microscopical examination will set all doubts at rest.

Prognosis. — This disease is rapidly amenable to the following method of treatment, a few days or weeks, at most, effecting a cure.

Treatment.—The ear should be syringed with a quite warm solution of bichloride of mercury in water, 1 to 5000. Enough should be used to dislodge and remove all cerumen, discharges, false membrane, and *débris* that the ear may contain. The class of people in whom the mold is found work or live in a dirty atmosphere, and the ears are a label of this fact. After absolute cleanliness has been effected, the meatus should be filled with warm hydrozone (dioxide of hydrogen, peroxide, H_2O_2). This is left as long as it effervesces, then removed, and the canal is gently dried with absorbent cotton. Now the meatus is filled with a 12-per-cent. solution of carbolic acid in glycerin for ten minutes; then this is removed and a saturated solution of iodoform in alcohol is substituted. The carbolic acid does not corrode the tissues in this combination, but acts as an antiseptic, besides anæsthetizing the inflamed skin sufficiently to admit of the strong alcoholic solution being used without producing pain. The iodoform solution is left in the ear with the patient's head inclined to the opposite shoulder for ten minutes, when it is allowed to drain out slowly, leaving a covering of iodoform powder on the surface of the drumhead and walls of the meatus. This treatment destroys any remaining fungi. The canal is then dried and dusted with a coating of aristol, and stoppered with absorbent cotton until the next treatment on the following or second day. Should there be a considerable exudation of serum, boric-acid powder may take the place of aristol or may be added to it. If the drumhead has been perforated or if the mastoid cells have been invaded, suitable treatment, such as will be detailed in the chapters on those subjects, must be adapted to such complications.

Exostoses or bony growths from the osseous section of the external meatus are so rare that we will not enter into their consideration here, except to remark that unless they occasion serious trouble they do not require attention; but if they become obstructive they must be removed.

IMPERFORATE EXTERNAL MEATUS.

At the Tenth International Medical Congress the author reported four cases of complete closure or absence of the auditory meatus,—two traumatic and two congenital. In the two congenital cases no external canal could be demonstrated. One of the traumatic cases was produced by a railroad accident that amputated the auricle, which was replaced and carelessly sewed over the canal to present a good appearance at the funeral; but the patient recovered. A few years afterward the author made a new canal, maintained its patency by means of a hard-rubber tube, and succeeded in restoring the usefulness of the organ. The other traumatic case was a man 32 years of age. It was caused by a wagon-wheel severing the auricle from the head when the patient was 3 years old. The same error was committed in stitching the auricle over the mouth of the canal. When the patient came for treatment there was a discharge of pus from a very minute fistula in the roof of what should have been the canal. I opened the canal, cauterized the cicatricial tissues, and maintained the opening by means of a vulcanite tube. In the two congenital cases I operated on one, a girl 6 months old, but found no osseous canal; in the other, an infant of 14 months, no operation was advised. Adhesions causing closure of the canal are very rare.

Some of our authorities speak of imperforate external auditory canals as though they were of frequent occurrence; but among my records, embracing more than 21,000 cases of diseases of the ear, we found but 1 case of closure from exostosis, 3 cases of congenital absence of the meatus, and 3 of traumatic closure. There were numerous cases of narrowing, and various irregularities of the canal, from causes that are not uncommon.

Foreign Bodies in the External Meatus.

It is a common occurrence to find peas, beans, pebbles, and glass beads that children have introduced into their own or their companions' ears. We have found flies, bedbugs, live moth-millers, etc., but flies are oftener found in suppurating ears. It is not uncommon to find oats and other foreign bodies that have remained in the ears for years without provoking symptoms that made their presence known. Sir William Bartlett Dalby found a piece of slate-pencil that had been in the ear for 30 years, and a stone that had been there for over 50 years. Notwithstanding this, a foreign body is a menace to the integrity of the hearing organ so long as it remains in the canal. It may at any time set up an inflammation either by mechanical irritation, or, if it be an organic substance, by swelling and by decomposition.

These bodies are easily seen if the forehead-mirror, bright light, and a funnel are employed. But the funnel must not be allowed to crowd the body down farther into the canal. Insects, if alive, should either be immediately picked out with the delicate forceps (Fig. 145) or drowned by filling the ear at once with warm water. Beans, corn, peas, etc., absorb moisture and swell so as to completely fill the canal until their pressure becomes painful. They are easiest removed by passing the little sharp hook, contained in the author's middle-ear case, over the grain with the hook lying in a horizontal plane next to the canal-roof; or, if there is greater space at any other point, we should choose it and carry the hook well over the berry, then turn the point toward the centre of the berry and press it firmly so as to imbed it in its substance. Careful traction will then extract it. Hard, inorganic bodies are not so easily extracted. Syringing is safest, with the head inclined toward the basin so that gravity will aid in their expulsion. They may be wedged into the meatus so that the current of water cannot dislodge them. Then the little blunt lever, instead of the sharp hook, may be passed behind the body and drawn upon, care being had not to allow it to slip over or around the body, leaving the latter behind. When glass beads work into the middle ear, the operation for extraction is not so simple a matter. The author has the ornament of a "ruby" ring that could not be removed from the tympanic cavity until we had detached the auricle and chiseled away a section of the bony canal. The "ruby" is five-sixteenths of an inch (eight millimetres) in diameter and cut similarly to a diamond; so that instruments could gain no hold upon the facets. D. B. St. John Roosa and Albert H. Buck report similar cases. Roosa removed a shot from the middle ear, and Buck extracted a hard locust bean by means of the same operation.

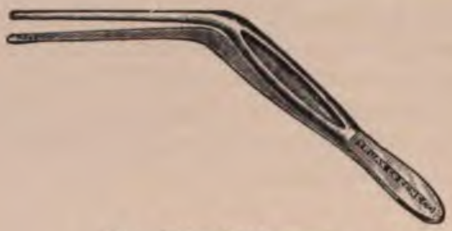


Fig. 145.—Ear-forceps.

Extreme care should be exercised, in efforts to remove foreign bodies, not to injure either the canal or drumhead and ossicles. We have seen numerous instances in which unskillful practitioners had mutilated the canal-walls and drum-membranes, and even extracted the little bones before they discovered that there really had been no foreign body in the ear. Such practices are appalling. It is frequently necessary to assure anxious parents that they and their children are mistaken, when they bring their little ones to have foreign bodies extracted, for we often find that there is absolutely no evidence that any foreign body has been there.

CHAPTER XXXIV.

DISEASES OF THE MIDDLE EAR.

INJURIES TO THE DRUMHEAD.

THE drumhead is occasionally ruptured by blows (Fig. 146), explosions, concussions from firearms, the pushing of pencils or straws into the ear, or by pulling the ears of children. Gorham Bacon says that during the laying of the foundations of the Brooklyn bridge many of the men working in the caissons suffered from rupture of the drumhead; but A. H. Smith, the medical officer in charge of the men, believed that, in all those who suffered from an aural affection after working in the caissons, there already existed some obstruction to the entrance of air through the Eustachian tubes. The mere rupture of the membrane is not usually of very serious import, for it will probably close in a few days without treatment; but concussions or wounds may penetrate sufficiently to affect seriously the middle or internal ear. If no inflammation follow such accidents, the perforation itself requires no treatment further than to protect it from the air-currents by a light pledget of sterilized cotton. The consequent affections are treated in their proper classifications.

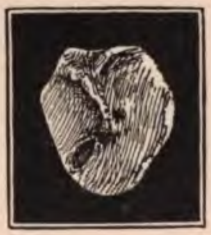


Fig. 146.—Rupture of the Antero-inferior Segment of the Drumhead caused by a Box on the Ear. (After Politzer.)

INFLAMMATION OF THE DRUMHEAD.

Synonym.—Myringitis.

Pathology.—Myringitis is of frequent occurrence and generally begins with an injection of the malleal plexus of vessels. At first

PLATE VIII.

PLATE VIII.

FIG. 1.—Normal membrana tympani of the right side, showing the incudo-stapedial joint.

FIG. 2.—Hyperæmia of the right tympanic membrane. Slight injection of the vessels running alongside of the hammer. Injection of the radiating vessels of the posterior segment, in a case of otitis media acuta. Duration, 9 days; female patient; age, 37 years.

FIG. 3.—Injection of the radiating blood-vessels of the left tympanic membrane in a state of retrogression. A case of acute otitis media of 10 days' standing; female patient; age, 45.

FIG. 4.—Myringitis bullosa, showing formation of a blister the size of a hemp-seed, situated behind the umbo; second day of the disease; male patient; age, 19.

FIG. 5.—Myringitis granulosa with extensive formation of sharply defined wart-like elevations or excrescences on the lower segment of the tympanic membrane. Numerous punctiform light-reflections appear on the granular surface. Duration, 6 months; age, 25. Completely cured after several applications of liquor ferri sesquichlorati.

FIG. 6.—Myringitis granulosa chronica, the granulations covering nearly the entire tympanic membrane. Duration, unknown; female; age, 26.

FIG. 7.—Catarrh of the middle ear, with secretion of an intensely yellow color in the lower portion of the tympanum, and bulging of the lower segment of the drumhead. Duration, 2 weeks; for 4 days there had been a marked injection of the vessels surrounding the handle of the hammer and those supplying the upper segment of the membrane. Acoumeter heard only on contact; conversational voice close to the ear. Age, 15.

FIG. 8.—Secretive middle-ear catarrh, with great retraction of the tympanic membrane, which is of a yellowish-gray color. The posterior fold of the membrane is extremely prominent, and the lateral and middle folds of Shrapnell's membrane are well defined. Duration, 14 days; age, 28.

FIG. 9.—Chronic middle-ear catarrh. Retraction of the tympanic membrane, the hammer being invisible owing to the great prominence of the posterior fold, which describes a curve extending from the short process above and in front and terminating below and posteriorly in the lower segment of the membrane.

FIG. 10.—Chronic catarrh of the middle ear with cretaceous deposit in the drumhead, anterior to the hammer-handle.

FIG. 11.—Two crescentic deposits of chalk embracing the handle of the malleus. Great impairment of hearing associated with continuous subjective noises in the ear. Duration more than 6 months; female; age, 18.

FIG. 12.—Crescentic chalk deposit enveloping the umbo, or the deep concavity corresponding to the inferior extremity of the malleus.

FIG. 13.—Acute suppurative inflammation of the middle ear. Tympanic membrane of a red color and covered with a thin layer of exudation. A round perforation in the lower segment. Otorrhœa is said to have developed one hour after the painful symptoms began. Duration, 14 days; age, 39.

FIG. 14.—Acute suppurative inflammation of the middle ear, tubercular. Anterior half of the drumhead is deeply injected, the posterior segment has a pale-gray color. Behind the malleus are two small tubercular excrescences, a capillary blood-vessel crossing them from above. Two minute punctiform perforations above the tubercles. Duration, 5 days; age, 25.

FIG. 15.—Acute suppurative inflammation of the middle ear. Drumhead is yellowish gray, the external layer of the membrane appearing quite loose. Processus brevis scarcely visible. Beneath the umbo is a minute perforation. Duration, 12 days; age, 33.

FIG. 16.—Chronic suppurative inflammation of the middle ear. Oval perforation in the anterior, inferior quadrant of the drumhead; round perforation in Shrapnell's membrane. The external layer of the remaining portion of the membrane is quite loose and of a gray color. Duration of the discharge from the ear was 2 years; age, 28.

FIG. 17.—Chronic suppurative inflammation of the middle ear; round perforation in the superior segment of the drumhead. The mucous membrane of the tympanic cavity is of a dark-red color, and the drumhead of a light-gray color. The short process is visible. Age, 11.

FIG. 18.—Chronic suppurative inflammation of the middle ear. Large defect of the posterior half of the drumhead. The mucous membrane covering the promontory is dark red and shining; the remaining portion of the membrane is grayish red. The handle of the hammer is hardly visible. In the upper portion of the perforation the round head of the stapes can be seen. Duration, 10 years; age, 41.

FIG. 19.—Chronic suppurative inflammation of the middle ear, with extensive destruction of the membrana tympani. Toward the periphery is the narrow, grayish-white remnant of the membrane. The mucous membrane of the inner wall of the tympanum is deeply red and swollen. The handle of the mallet occupies its normal position, hanging free in the perforation. Disease continued from childhood; age, 22.

FIG. 20.—Chronic suppurative inflammation of the middle ear; very large perforation of the drumhead; remaining portion grayish yellow and thickened; somewhat bulging on account of a dark-red polypoid growth in the region of the promontory. Short process is barely visible. Duration, 10 years; female; age, 29.

FIG. 21.—Dry perforation below the umbo, the size of a pin-head; blood-vessels around the handle of the hammer are much injected. The drumhead is grayish red. In front and behind the malleus are crescentic, serrated deposits of chalk. Duration, since childhood; age, 41.

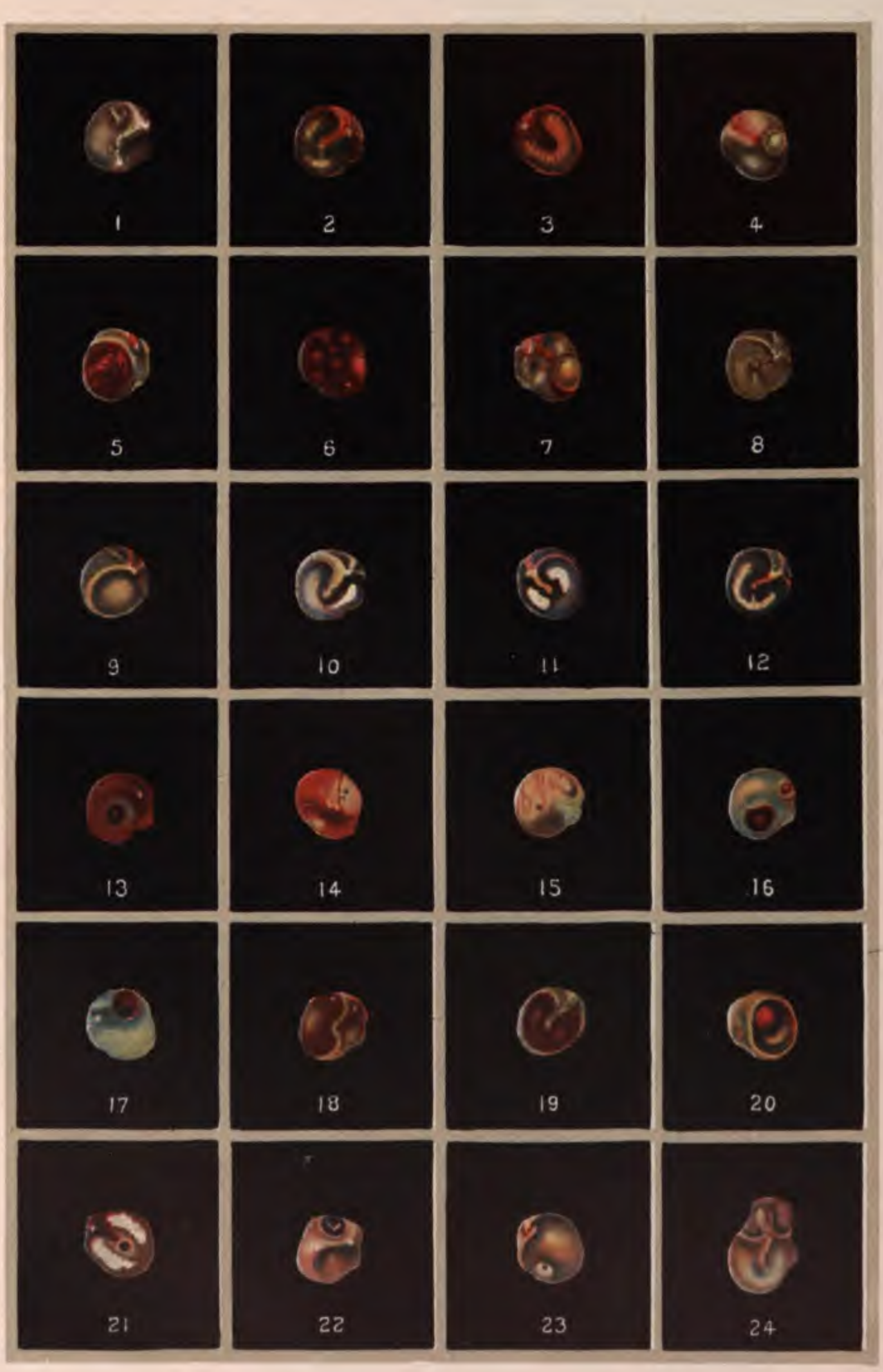
FIG. 22.—Cicatricial adhesion of the drumhead to the inner wall of the tympanum. The membrane is retracted behind the malleus and attached to the incudo-stapedial joint. The anterior portion of the drumhead, also, is retracted and attached to the inner wall of the middle ear. The unusually prominent handle of the mallet becomes less prominent as it extends downward toward the promontory, which is covered by scar-tissue. Duration, unknown; age, 28.

FIG. 23.—Defect of the drumhead, only a small portion remaining, which is connected with the retracted handle of the mallet. The inner tympanic wall is of a grayish color. In front of the opening leading to the Eustachian tube a membranous septum is stretched, with a minute perforation. Duration, 15 years; female; age, 56.

FIG. 24.—Destruction of Shrapnell's membrane; large bony defect of the outer wall of the attic, through which the disarticulated head of the hammer is visible. The incus is missing. The tympanic membrane is opaque and marked by a sharp, white border toward the defect. Duration, 20 years; female; age, 30.

Reproduced, by permission, from the "Atlas der Beleuchtungsbilder des Trommelfells in gesunden und in Kranken Zustande." Fourteen plates, 390 drawings, von Prof. A. Politzer. Wien bei Braumuller & Sohn.

PLATE VIII.



they can be distinctly seen like minute red threads extending downward along the hammer-handle, but as the hyperæmia increases they appear to coalesce until there is an even diffusion of redness enveloping the handle and overspreading the membrana Shrapnelli (Fig. 118) like an intense blush. This condition may co-exist with a dermatitis of the superior integumentary wall of the external meatus. In these cases one cannot discern any line of demarkation between the lining of the wall and the drum-membrane. I remember to have seen an abscess in the drumhead of a violinist, located in the region of Prussak's space (Fig. 147). The hook-knife (Fig. 181) was introduced from above and brought downward and outward, dividing the external wall, thus laying the little abscess-walls open to view. Occasionally hæmorrhagic effusions are seen, but the blisters described by Politzer we have rarely observed. When the inflammation extends over the whole area of the membrane it assumes a cherry-red color, shining at first, swollen and dusky after serous infiltration takes place (Plate VIII).

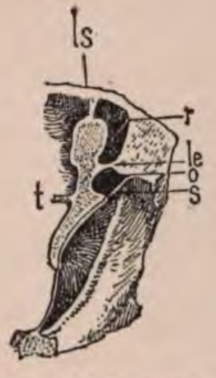


Fig. 147.—Section through the Tympanic Membrane, Malleus, and Upper and Outer Tympanic Wall of a Decalcified Preparation. (After Politzer.) *ls*, Ligament. mall. sup. *le*, Ligament. mall. ext. *s*, Membrana Shrapnelli. *o*, Prussak's space. *r*, System of cavities between the body of the malleus and incus and the external tympanic wall. *t*, Tendon of the musc. tens. tymp.

Etiology.—The cause usually lies in wind or cold water reaching the drumhead (swimming), instillations of irritating substances into the ear, fungi, or acute cold in the head.

Symptomatology.—The hearing is not necessarily diminished for speech, but, on the other hand, there may be increased sensitiveness to noises. The pain is often severe and throbbing in character, accompanied with a feeling of fullness and pressure and subjective noises. Pain may be referred to the side of the head and neck, as well as to the ear itself.

Diagnosis.—In the early stage in the absence of pain this is not difficult, for the symptoms are not indicative of middle-ear inflammation except the appearance of the membrane. In mild cases the patient may not be aware of the presence of the trouble, although inspection reveals it, and the hearing is believed to be normal; but in acute middle-ear inflammation the Eustachian tube is usually involved, a rapid serous exudation takes place, and swelling of the membrane, with marked impairment of hearing. All the symptoms are characteristic of a more profound disturbance. After the inflammation extends from the drumhead to the middle ear the differential diagnosis is out of the question and immaterial.

Prognosis.—This is favorable, the disease being generally limited to a few days or a week.

Treatment.—If the pain is not severe the symptoms subside on warming pure vaselin and letting it run down upon the drum-membrane. Then the ear is closed with cotton to retain it for twenty-four hours. In severe pain an 8-per-cent. solution of cocaine or eucaine, quite warm, gives relief used in the same manner. No other treatment is necessary except for complications or after-effects of the disease.

EUSTACHIAN TUBAL CATARRH, OR SALPINGITIS.

Pathology. — In Eustachian salpingitis the mucous membrane lining the tube may be simply hyperæmic or highly inflamed. Since it is lined with a continuation of the same mucous lining as that of the naso-pharynx, on the one hand, and of the tympanic cavity, on the other (Fig. 148), any inflammatory action in one is likely to spread along the membrane to another part, just as an erysipelatous inflammation of the skin travels along the integument from one part of the body to another. In a transitory inflammation of the tube, mild in character, the mucous membrane alone may be affected, with only slight swelling and diminution of its calibre; but in a severer grade the submucous layer becomes involved, transudation of the fluid elements of the blood takes place, and great swelling and stenosis or complete closure of the tube occur. As a result of the latter condition, new connective-tissue formation may make the narrowing or imperviousness of the tube permanent. Both the inflammation and the constriction are principally confined to the cartilaginous part of the tube, and the connective-tissue strictures to the middle of this portion. Granulations sometimes result from the inflammation.

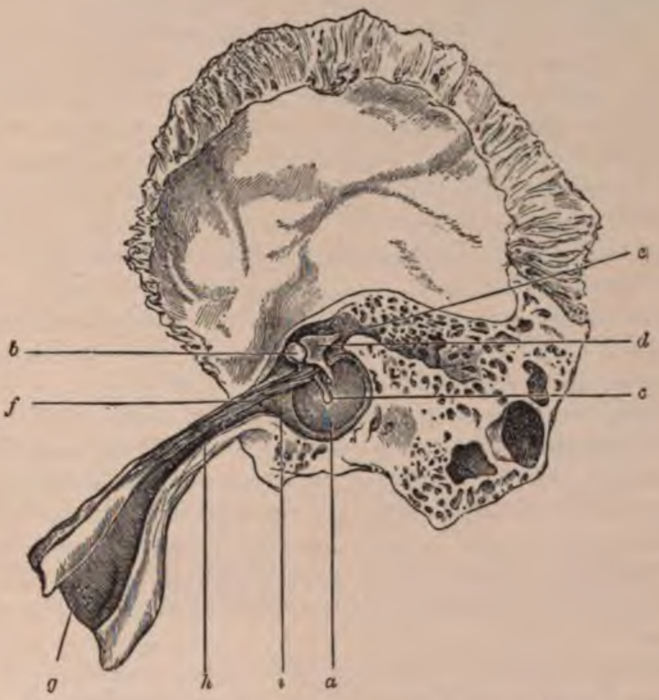


Fig. 148.—Eustachian Tube and Tympanic Cavity. (After Politzer.) *a*, Membrana tympani. *b*, Head of the malleus. *c*, Lower end of the handle of the malleus. *d*, Body of the incus. *e*, Short process of the incus. *f*, Tensor tympani. *g*, Orifice of the Eustachian tube. *h*, Isthmus of the tube. *i*, Tympanic mouth of the tube.

Etiology.—Tubal catarrh is rarely an idiopathic disease, but results either from an attack of acute coryza, or pharyngitis, or from a middle-ear catarrh. Cold winds blowing on the side of the neck, a blow, or irritating fluids in the naso-pharynx may act as causes. The presence of hypertrophied or inflamed oral tonsils, or of adenoid vegetations in the vault of the pharynx, which are the seat of frequently recurring attacks of inflammation, predisposes to the disease. Moreover, they form a *nidus* for pathogenic bacteria.

Symptomatology.—In light attacks there are only slight deafness and subjective noises, which increase with the severity of the inflammation. When the tube becomes greatly swollen there may be vertigo, and pain referred to the side of the neck, back of the ramus of the lower jaw. Pressure toward the course of the tube reveals tenderness. Auscultation gives a high-pitched, squeaking noise during politzerization, and, if mucus is present, a râle also in a swollen condition of the tube. These are not necessarily present in the constriction due to connective-tissue growth. In the latter the noise may be wanting. It is difficult or impossible to inflate the ear, or it will require high pressure to do so. The drumhead is sunken on account of the rapid absorption of air in the tympanic cavity and loss of the normal ventilation by the tube. The lower extremity of the mallet may lie close to the inner wall of the cavity, giving the hammer-handle a foreshortened appearance, and causing the short process to project outward prominently toward the examiner's eye. The membrane about the process looks stretched and drawn into folds.

Diagnosis.—This is not difficult and the principal points have been indicated in what has already been said. With no middle-ear involvement, the most striking result is obtained from inflation. The hearing is immediately restored and the differential diagnosis is confirmed.

Prognosis.—The attack of acute catarrh of the tube is readily subdued, and proper treatment will soon restore the parts to a normal condition.

Treatment.—This must be directed to the condition of the tube itself, to the causes that induce the attacks, and to the predisposing causes. The most immediate relief is afforded the patient if we can at once inflate the middle ear. This restores the normal hearing, relieves the tension of the drum-membrane, reduces the engorgement of the blood-vessels by relieving the partial vacuum; removes the cause of dizziness, the impaction of the stirrup; and lifts the patient out of his mental gloom,—a condition characteristic of this disease. The catheter should be avoided, since its introduction into the orifice of the inflamed tube serves only to increase the irritation. Politzerization is, by far, preferable, at first with air alone, to gently and gradually fill the tympanic cavity and restore the drumhead to its normal position. Too sudden inflation in this state may cause distress, vertigo, and nausea by the disturbance of the intralabyrinthal fluid. The tube being opened, it is my practice to inject with the improved inflator (Fig. 134) either pure lavolin—a purified non-irritating fluid vaselin—or a weak solution of camphor-menthol in lavolin, 3 per cent. The former is bland and emollient, as well as protective to the inflamed membrane. The latter relieves the pain, constricts the capillary blood-vessels, reduces the swelling and stenosis, and acts as an antiseptic and protective. If the tube does not readily yield to the inflation, 6 or 10 drops of sulphuric ether may be placed on the sponges of the inflator, and, with sufficient pressure from the compressed-air reservoir and while the patient swallows, this will, in most cases, reach the middle ear. There is not sufficient ether to produce irritation, but it is so volatile that it will penetrate where air alone fails to go.

My experience differs somewhat from that of other observers concerning tubal affections. We have rarely met cases of constriction that we were not able to overcome without the use of the bougie. This may be attributed, perhaps, to the greater air-pressure employed in my work. Moreover, it is rarely found necessary to introduce the catheter,—for the same reason, no doubt. Handbags are little used in my private practice or in my hospital and college clinics, but, instead, we make use of air in reservoirs compressed by hydraulic compound pumps, Westinghouse air-pumps, or some other device supplying at least three or four times the amount of force obtainable from the rubber airbags. But the amount of pressure is regulated by valves and airmeters so as to place it under the accurate control of the operator and render it safe.

Bougies have their disadvantages. They may abrade or lacerate the membrane of the tube and penetrate its weakened walls, or they may be carried onward into the tympanic cavity and dislocate the ossicles or perforate the membrana tympani. Air and emollient or stimulating medicaments are devoid of these dangers. Generally but a few treatments are required to open the tube and maintain its patency. I remember but two cases in which it required as long as three weeks of treatment without the bougie to effect this result. One was in a chronic catarrhal condition with connective-tissue stricture, but the result was satisfactory. The other required the bougie. A. B. Duel reports excellent results from electrolysis for stenosis (*The Laryngoscope*, February, 1898). The second indication for treatment is the reduction of the naso-pharyngeal or tympanic catarrh that may have given rise to the tubal trouble. But, since these conditions and the predisposing causes are treated of in their proper sections, we will not make mention of them here.

ACUTE INFLAMMATION OF THE MIDDLE EAR.

Synonyms.—Otitis media acuta; acute tympanitis.

Pathology.—Otitis media acuta presents at first a glow of redness of the lining mucous membrane of the middle ear, due to the beginning hyperæmia. This is perceptible through a translucent drumhead, and is followed rapidly by an effusion of serum and mucus into the tympanic cavity. These stages of inflammation follow each other in quick succession, and the disease itself is of short duration. The mucous membrane becomes tumefied and the epithelium becomes opaque and exfoliated. In a certain form of acute inflammation which is especially characteristic of the epidemic influenza, or, as it is generally known, the grip, there is so sudden an exudation as to cause rupture of the blood-vessels, and within twelve or twenty-four hours of the onset there is a copious, bloody, serous effusion and rupture of the membrana tympani. I have observed an influx of this type of the disease within a few days of the breaking out of the epidemic influenza in Chicago.

Etiology.—This affection most often results from a cold in the head, and may be caused by an inflammation of any portion of the upper respiratory tract and by the eruptive fevers. Cold winds blowing in the ear, getting wet, bathing, influenza, cauterizing the nose and throat, pouring or sniffing cold fluids into the nose, and the entrance of soap and water into the auditory meatus are prolific causes. It is more common to childhood than adult life. F. C. Hotz believes that malarial poison is sometimes a cause.

Symptomatology.—Sensations of itching in the ear sometimes call the patient's attention to it before the actual pain begins, but the pains in other instances come on suddenly and without warning, and rapidly increase in intensity until they become unbearable. Especially is this the case in children, who are thrown into a fever, delirium, and even convulsions, so exquisite is the suffering. The pain is increased by sneezing, swallowing, and coughing, and it may radiate to the side of the head and teeth, or there is a sensation of numbness in the corresponding side of the head. Autophony, or a hollow sound of the patient's voice as perceived by himself, adds to his discomfort. If great pressure is exerted by an abundance of exudation, giddiness is experienced. Undoubtedly the labyrinth often participates in the disturbance to the extent of becoming hyperæmic, in which case subjective sounds become intense and even rhythmic, varying synchronously with the heart's pulsations. It is not unusual to meet with a mild type of this disease in which all the symptoms are diminished in intensity and some are absent. Before the exudation occurs the hearing may show no impairment, but afterward it decreases proportionately to the amount of tumefaction and secretion. Bone-conduction is normal.

Inspection reveals, in the beginning of the attack, a drumhead presenting the appearance described under the caption of "Myringitis" (Fig. 149 and Plate VIII). The malleal plexus of vessels is injected with blood; their tracery along the upper region of the hammer-handle is distinctly made out; a red areola shows about the processus brevis, and later a glow of redness covers the membrana flaccida. As the inflammation progresses the red appearance extends to every part of the membrane until it looks like a ripe cherry in the ear. Later, as the serous infiltration increases, the outlines of the handle become dimmed and disappear; the lustre of the membrane is lost, and in its place a dull, swollen surface presents. When the tympanic cavity becomes filled with secretions, inequalities of the surface of the membrane are visible, and a bulging in some part may indicate the pressure of fluid from within. Indeed, the whole membrane may become bulged outward, and the radiate traceries of the injected vessels show like the spokes of a wheel (Fig. 150).

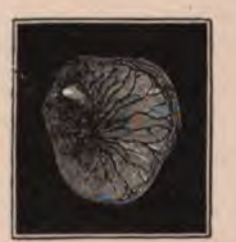


Fig. 149.—Radiate Vascular Injection of the Drumhead. (After Politzer.)

As the inflammation subsides the redness of the drumhead fades away, the pain ceases, the hearing improves, the noises diminish, and a general sense of relief takes the place of a stormy experience. The membrana tympani assumes a lustreless, ashy-gray color, and its opacity remains for a considerable time, and may become permanent.

Diagnosis.—There is little likelihood of confounding this disease with any other save myringitis alone. The latter forms a factor in the present case and can, without much confusion, be separated from it. In the inflammation involving the whole of the cavity all the symptoms of inflammation of the drumhead alone are augmented, while others are ingrafted upon it. The great impairment of hearing after effusion, the general symptoms, and their duration are decisive. Children work at the affected ear, press it against warm objects, or incline the head to the diseased side.

Prognosis. — The tendency is to resolution in healthy patients under favoring circumstances. In the opposite condition the tendency is either to suppuration and perforation of the drumhead or to a chronic dry catarrhal state.

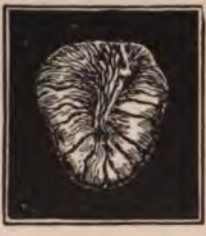


Fig. 150.—Radiate Vascular Appearance in Acute Inflammation of the Middle Ear. (After Politzer.)

Treatment.—In the first stage, or before the serous effusion has taken place or the pain has become severe, gentle inflation and filling the ear-canal with warmed pure or carbolated vaselin will suffice to give relief. When the pain has become intense, inflation must be made under very low pressure, as the movements of the drumhead, like those of an inflamed joint, are exquisitely painful. The patient in this stage should be put to bed to keep the temperature equable, a warm 8-per-cent. solution of cocaine may be instilled into the ear, and, if deemed necessary, $^1/_8$ grain of morphia can be given in combination with $^1/_{400}$ grain of atropia for an adult. If for any reason the morphia and atropia should not be prescribed, bromidia may be substituted in teaspoonful doses, in water, every half-hour until relief is obtained. Then it must be discontinued. The bowels and general health should receive proper attention. We have often found that leeches gave speedy relief. Two Spanish leeches may be applied in front of the tragus and two behind the auricle for adults. The external canal is stoppered with cotton so that the leeches cannot enter it. The skin is pricked until a drop of blood appears; then the leech in a two-drachm vial, with its mouth at the opening of the bottle, is placed so that its mouth covers the drop of blood. The vial is held in position until the leech takes secure hold. Then the bottle is removed and the leech allowed to fill and drop off. This manner of applying leeches is given because few seem to be conversant with the subject, and this method removes the common objection to handling such repulsive animals. Especial care should be exercised to abstract the blood in middle-ear inflammation as much as possible from the region of the tragus, on account of the intimate relation of the blood-vessels of this region and the anterior wall of the meatus with the vessels of the tympanic cavity. If enough blood has not been abstracted after the leeches fill and fall off, more can be drawn by applying napkins wrung out of warm water. If there should be any difficulty in stopping the bleeding of the leech-bites, pressure applied to them will succeed. The artificial leech is also an excellent device, but occasions more discomfort.

The common practice indulged in by the laity of pouring oils, onion-juice, etc., into the ear is a vicious one, since these become rancid and irritating and predispose to a subsequent inflammation. Poultices are also mischievous and favor suppuration and perforation of the drum-membrane. The author has seen the following simple device, always convenient, give grateful relief: A piece of clean cotton is placed lightly in the mouth of the canal. A pipe is partly filled with tobacco and lighted. Then a piece of thin cloth is placed over the mouth of the pipe-bowl and gently blown through, while the lip-piece of the pipe-stem rests against the cotton pledget. This filters the warm smoke through the cotton into the canal, and a grateful sedative effect is soon obtained. I do not remember to have seen this remedy mentioned, but its efficacy in the absence of other remedies has been demonstrated.

Fever calls for antipyrin or its equivalent in some febrifuge that is less of a cardiac depressant. Phenacetin and acetanilid act well. Quinine, the enemy of the ear, must not be used. It aggravates the existing hyperæmia and conduces to permanent deafness. Alcoholic drinks and smoking are prohibited, and any inflammatory condition of the respiratory tract must be vigorously combated.

If the pain and bulging of the drumhead continue, notwithstanding all efforts to counteract the disease, and rupture of the membrane is threatened, it should be incised with the paracentesis-knife (Fig. 167, No. 2), in the postero-inferior quadrant, so as to afford the most perfect drainage. A warm, 8-per-cent. solution of cocaine should be left in the ear for twenty minutes before the paracentesis, and, if the pain does not soon cease after perforating, more cocaine should be instilled, as hot as can be comfortably borne, so as to percolate through the perforation and reach the mucous membrane within. This will give relief. The incision should be a long one, cutting through the entire area of the postero-inferior quadrant vertically. The longer it is, the more it relieves the tension of the nerves of the membrane and the freer the drainage. The paracentesis-knife must be absolutely sharp and dipped in alcohol before using. The perforation generally heals in a few days if no pus has formed. If we find suppuration has taken place, then we have a condition which is considered in the following chapter.

After the pain is relieved, which should be the object of our first efforts, the ear may be inflated with as low pressure as will accomplish it. The air-pressure in the tympanic cavity promotes absorption of any fluid contents and will likely improve the hearing. This treatment is administered daily for a few days. As improvement progresses the treatments can be given at greater intervals until the normal condition is established.

Diet, exercise, and clothing should be regulated on general hygienic principles.

CHAPTER XXXV.

DISEASES OF THE MIDDLE EAR *(Continued).*

ACUTE SUPPURATIVE INFLAMMATION OF THE MIDDLE EAR.

Synonyms.—Otitis media acuta suppurativa; acute suppurative tympanitis.

Pathology.—The tissue changes already set forth in the description of acute inflammation of the middle ear take place in the affection now under consideration previously to pus formation. In the suppurative form the inflammatory action is more intense; the tissues break down; the drumhead bulges with the pressure of the accumulated fluids (Fig. 151), becomes softened, and, yielding to the consequent pressure, ruptures. The whole tympanic cavity becomes involved, and the purulent discharge may find its way into the mastoid antrum and cells. This disease is practically a sequel of the one described in the foregoing chapter.

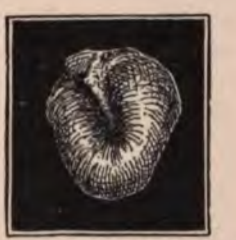


Fig. 151.—Convexity of the Drumhead Due to Pressure from Within. (After Politzer.)

Etiology.—The causes of acute inflammation of the tympanum and those that give rise to suppuration are identical, and to avoid unnecessary repetition the reader is referred to the preceding chapter. But, in the case of suppuration, there is probably an invasion of the middle ear by micro-organisms through the Eustachian tube. Bezold found the diplococcus pneumoniæ in suppuration of the middle ear in pneumonia. Streptococci or pneumococci are usually found in acute suppuration, followed by the staphylococci pyogenes.

Symptomatology.—The symptoms here are a repetition of those already described in treating of acute inflammation up to the point of pus production, but in a certain proportion of cases the acute inflammation runs its course without the train of distressing symptoms there described. It often happens, especially in children, that the first intimation the parents have of any ailment is the appearance of a discharge from the little one's ear. On the other hand, some children are so violently affected as to suggest meningeal or brain complication. In diseases that simulate intracranial affections the physician should never fail to examine the ears.

Diagnosis.—Before perforation takes place it may be impossible to differentiate between a simple acute inflammation with serous exudation into the tympanic cavity and a suppurative inflammation. As soon as rupture of the membrane occurs and the muco-purulent fluid is discharged into the meatus the diagnosis is cleared up. The appearance of the perforation (Plate VIII), which can generally be seen after removing the discharge, and the presence of the latter not being due to an inflammation of the meatus, together with the whistling sound resulting from forcing the air through the perforation during politzerization, present the factors of a positive diagnosis.

Prognosis.—If the habits of body are bad,—tubercular, syphilitic, etc.,—or if the suppuration result from diphtheria or scarlet fever, the prognosis is unfavorable; otherwise, when all the symptoms are ameliorated soon after the discharge appears, the outlook is favorable. There is reason for apprehension if the severity of the symptoms continue unabated after a free exit for the secretions has been provided for, either by nature or the surgeon. The author has often observed that, when the inflamed parts showed pulsation and were very sensitive to the gentlest touch of the cotton-fluff, the suppuration was difficult to cure. The pulsation, which is synchronous with the heart-beats, can be seen distinctly if bright light is caused to be reflected from a moist spot on the drumhead. The pulse can easily be counted in this manner. Bulging of either the posterior or superior wall of the meatus, or symptoms referable to the mastoid process, burrowing of pus, periostitis, or osteitis are indicative of serious complications.

Treatment.—In the preceding chapter, in treating of acute inflammation of the middle ear, are given in detail the methods that should be adopted in acute inflammation up to the time of suppuration and rupture or paracentesis of the membrana tympani, to which the reader is referred. Taking up the subject then, at the point where rupture has occurred by the efforts of nature to cast off noxious material and relieve pressure, the first observation to be made is relative to the capacity of the perforation to meet the necessity for free drainage. If the fluids are copious and the opening is too minute to admit of sufficient freedom of exit to the discharge, especially if the pain be continuous, the perforation should be enlarged vertically, as has already been described in the treatment of otitis media acuta. The tympanum must also be rendered freely accessible to the surgeon for the purposes of cleansing, disinfecting, and medicating the inflamed membrane within.

"J. H. Coulter favors a free incision of the membrane, with the incision carried along the superior wall of the canal." ("Year-book of the Nose, Throat, and Ear," 1901.)

Assuming now a free perforation, the external canal is dried out very gently with a fluffy cotton-twist projecting a quarter of an inch beyond the end of a small soft-silver cotton-carrier (Fig. 115). The cotton is rolled over the point of the carrier firmly enough to prevent it from penetrating the cotton and wounding the tissues, but beyond the twisted portion the cotton should be left in a downy tuft to absorb rapidly the fluids and to avoid any abrasion of the membrane. The cotton can be carried down into the fundus of the canal and brought in contact with the drumhead repeatedly until all the secretions are absorbed and extracted. As the last of these are dried up, the fluid from within the cavity may be seen oozing out, a drop at a time, or rolling down from a nipple-like perforation (Fig. 152). If one is not expert in the manipulation of these instruments, it is better to cleanse the canal by syringing it with a quart of water as warm as can be comfortably borne, the water having been sterilized by boiling for ten minutes.

After freeing the meatus of all discharges the ear is carefully inflated with as low pressure as will propel a column of air outward through the perforation. The discharges are by this means projected through the perforation into the canal with a whistling or bubbling sound. If too great force is exerted, unnecessary pain is caused. Any fluids ejected into the meatus are then removed; the canal is dried, and insufflated with aristol from the small powder-blower (Fig. 144). This remedy is preferable to boric acid in that it possesses a feeble anæsthetic property. It is an excellent cicatrizant, and, being an impalpable powder, it can be dusted through a narrow perforation.

Or we may employ nosophen, which, having no odor or irritating qualities, with decided antiseptic and healing properties, possesses undoubted merits. It is a very light, impalpable powder, that is easily thrown in the form of a dust over the surface treated, and it contains nearly 62 per cent. of iodine in combination.

It is the practice of some aurists to instill alcohol into the ear during an acute suppurative inflammation, but there is danger of not only causing increased suffering, but of aggravating the inflammatory action. Moreover, the dry method of treatment is preferable, and had best be employed first. Great care should be exercised to prevent any infection of the ear by means of the cotton, the surgeon's fingers, or the powders used, and patients must be cautioned against placing impure cotton in their ears.

A small pledget of absorbent cotton is introduced lightly into the mouth of the meatus and allowed to remain until a further discharge appears. Patients are instructed to let their ears entirely alone in case they remain dry after treatment, but if the cotton becomes moist with the discharge they may syringe the ear (Fig. 143), as previously described, and instill a warm, saturated solution of boric acid in water or rose-water, allow it to remain ten minutes, then let it escape, and close the ear lightly again with clean cotton.

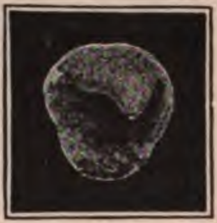


Fig. 152.—Nipple-shaped Bulging of the Posterior Portion of the Drumhead, on the Summit of which is the Perforation. (After Politzer.)

The cotton stopper protects the sensitive drum from cold winds or draughts and absorbs moisture. This constitutes an ideal dressing, and in suppuration of the ear, as of other organs, the drier the treatment, the better the results. The ear already presents the most favorable condition for the development and propagation of bacteria—warmth and moisture. This condition we must combat; so that, whatever our treatment may consist in, the aim should be to leave the parts as dry as possible. For this reason boric acid is an excellent dressing, especially when all acute symptoms have subsided. However, during the acute stage boric acid may cause pain for several hours after its application. We have met with quite a number of such instances in which it became necessary to discontinue the use of this powder. We have suspected that certain individuals possess an idiosyncrasy against it, but, if it produce no discomfort, excellent results may be expected. It absorbs moisture and dries the tissues. If fluids come in contact with it a saturated solution of boric acid is formed, which may percolate through the perforation into the middle ear and there exercise its feebly germicidal power. No powder, however, should be firmly packed into the ear, for it would prevent the escape of discharges and cause them to seek an outlet elsewhere: through the Eustachian tube if it were fortunately pervious, or through the mastoid antrum and cells, or even by way of the internal meatus or the tympanic roof to the cranial cavity. Moreover, it should never be forgotten how intimately the middle ear and mastoid spaces are related to the contents of the cranial cavity by the connecting blood-vessels, lymphatics, and by occasional defects in the superior surface of the temporal bone. These conditions emphasize the necessity of always keeping the passageway for the flow outward unobstructed.

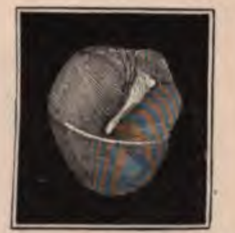


Fig. 153.—Fluid Effusion in the Tympanic Cavity, Marked by a Bright Line. (After Politzer.)

In case the drum-membrane and the canal remain very sensitive and pain continues unabated in the ear, a 12-per-cent. solution of carbolic acid in glycerin generally gives relief. The acid anæsthetizes and disinfects without corroding the tissues when combined in this proportion with glycerin, and the latter unloads the blood-vessels of their superabundant serum. The turgescence of the vessels is diminished and the pain relieved. General treatment is to be resorted to when the conditions demand it. The body should be protected from sudden atmospheric changes by wearing wool next to the skin. Further elucidation of this subject will be found under the heading of "Treatment" of coryza.

Since the disease under consideration is largely the result of acute catarrh of the nose and throat, coincident treatment should always be addressed to the naso-pharyngeal affection, and our efforts must be directed toward removing any permanent causes of recurring attacks, such as hypertrophies in the nasal chambers, adenoid growths in the pharynx, and enlarged tonsils. (See chapters on these subjects.)

Chronic Non-suppurative Inflammation of the Middle Ear.

Under this name are classed hypertrophic middle-ear catarrh and adhesive middle-ear catarrh, commonly called sclerosis (see Chapter XXXVI).

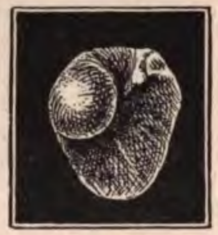


Fig. 154.—Circumscribed Bulging of the Drumhead. Due to Pressure of Fluid in the Middle Ear. (After Politzer.)

HYPERTROPHIC, OR SECRETIVE, CATARRH OF THE MIDDLE EAR.

Synonym.—Hypertrophic tympanitis.

Pathology.—Hypertrophic, or secretive, catarrh of the middle ear generally occurs in association with a similar condition of the nose and naso-pharynx. There is an hyperæmic condition of the mucous membrane lining the tympanic cavity, with hypersecretion of a serous or mucous character. The exudation may be visible (Figs. 153 and 154 and Plate VIII) if the drumhead has not lost its translucency, more especially when air has been forced through the Eustachian tube into the fluid, thereby causing bubbles or a frothy appearance. In this disease the tube generally participates to the extent of losing its patency; so that the normal supply of air in the tympanic cavity is cut off. The result is that the air in the middle ear is absorbed; so that the resistance of the drumhead to the outer atmospheric pressure of nearly fifteen pounds to the square inch is lost, and the membrane is forced inward toward the inner tympanic wall. The effect of this encroachment upon the tympanic space is easily visible in the increased concavity of the membrane, the foreshortening of the hammer-handle, the emphasizing of the posterior fold, and the changed location of the reflection of light.

The drumhead yields to the atmospheric pressure from without when the counteracting air-pressure from within is lost, and lies, possibly, in contact with the inner wall, especially the posterior half. In this case it may so embrace the long process of the anvil and the posterior crus of the stirrup as to show their projecting outlines and those of the promontory and round window. The mallet-handle may at first seem to be invisible until one looks from below upward as much as possible, when it is seen occupying an almost horizontal position (Fig. 155 and Plate VIII), running directly inward until its lower extremity lies in contact with the inner wall of the cavity (Fig. 158). The short process is thrown outward by this position toward the examiner's eye like a little yellow knuckle covered with membrane that is stretched into tense folds above. If the drumhead is still lustrous the triangle of light has been moved from its normal position, or there is a circular reflection of light from the most depressed section, or there may be several dots of light, owing to the irregular surface produced by the varying degrees of depression in different parts of the membrane. In an advanced stage these irregularities of retraction are due to an atrophied condition of one or more parts of the membrane, and, unless a careful inspection is made, these atrophies may be easily mistaken for cicatrices. The latter, however, are more clearly defined by the distinct line forming a border to a previous perforation and

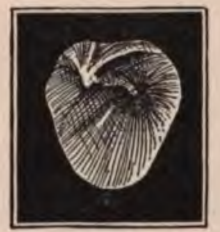


Fig. 155.—Great Concavity of the Drumhead and Foreshortening of the Hammer-handle. (After Politzer.)

now separating the cicatricial tissue from the opaque, thickened surrounding membrane. The atrophic area blends gradually in more indefinite outlines with the adjoining hypertrophic tissue.

The manipulation of the massage otoscope (Fig. 114) shows these atrophic and cicatricial sections with unmistakable clearness. When the air is rarefied in the canal, these spots bulge outward like balloons, as if they might burst. Indeed, they probably could be easily ruptured if much force were exerted. They show exaggerated movements when the remainder of the membrane and the mallet are completely quiescent. But, when the drumhead is depressed against the inner tympanic wall and has become adherent to it by organic adhesions, these adhesions prevent the depressed area from responding to the pneumatic otoscope.

In the advanced stage of this disease the drumhead may become very greatly thickened and of a milky opacity, and hypersecretion and impaction of cerumen are frequently found.

Etiology.—Acute colds in the head, influenza, the eruptive fevers, chronic naso-pharyngeal catarrh, and syphilis act as the exciting causes of this affection. Impermeability of the Eustachian tube, with consequent rarefaction of the air in the middle ear, causes an exudation of serous fluid, retraction of the drumhead, etc., which may only prove to be transitory if the cause of the tubal stenosis is speedily removed, or, if it is not, permanent tissue changes may occur, resulting in the more serious conditions described. George A. Leland makes the point that ear disease results from frequent and forceful efforts to clear the nose. The air is blown into the middle ears with sufficient pressure to stretch the drumheads and cause ultimate relaxation.

Symptomatology.—This is not a painful affection, although in the early stages slight twinges or darting and shooting transitory pains may occur. Sensations of fullness in the ear, pressure, and as if something were moving in the ear are complained of. The last symptom is produced by movements of the fluid contents of the tympanic cavity, owing to the varying positions of the head, and to the entrance of air into the fluid through the tube. The last cause also gives rise to bubbling, snapping, and crackling sounds. These râles result from the separating of the walls of the Eustachian tube also, when it is involved, as air passes through. The viscous mucous secretion agglutinates the walls together, and as they separate the clinging mucus first sticks, then stretches into filaments, and finally the breaking of these occasions the crackling noises. The movements of the jaw aggravate these symptoms. Sensations of numbness in the corresponding side of the head, confusion of ideas and speech, irritability of temper, and autophony—or a disagreeable hollow sound of one's own voice, as if talking into an empty barrel—are characteristic of this disease.

The swelling of the tissues and increased tension of the drumhead and ossicles may produce labyrinthal pressure with a sense of light-headedness, giddiness, and subjective noises, although the latter constitute one of the principal symptoms of sclerosis. The hearing varies greatly with the weather conditions. Low barometer and thermometer, with great humidity of the atmosphere, increase the impairment of hearing, the sensations of stuffiness and fullness, and tinnitus aurium. Sudden changes to these atmospheric conditions from a warm, dry air are certain to aggravate the aural symptoms. Patients can predict approaching weather changes by the phenomena mentioned. Alcoholic stimulants and colds in the head also increase these distressing symptoms.

Diagnosis.—It is not difficult to determine the presence of the secretive form of catarrh. If the drumhead is yet translucent the line in the membrane indicating the surface of the liquid (Fig. 153) can be made out unless it extends above into the attic, or the propelling of air into it can be heard to produce bubbling sounds, and in the early stages the hearing may not be greatly impaired or it is much improved by politzerization. The patient is generally young, bone-conduction for the watch and tuning-fork is good, and the disease is far more amenable to treatment than sclerosis.

Prognosis. — This is favorable if we can exclude heredity, bad sanitary influences, and general ill health, and if the attack is not of long duration. Especially is this so if inflation of the ear and removal of any contained fluid result in decided improvement in the symptoms and if the bone-conduction is good. But examination of the nose and throat will throw important light on this subject. If there are no hypertrophies and exostoses, but a simple catarrh of recent origin, a cure is rapidly effected.

Treatment.—Attention must first be directed to the passages that lead to the middle ear. If there is a catarrhal condition of the nose and throat that may have given rise to the middle-ear disease, it should receive proper treatment at the same time with the Eustachian tube and tympanum. Permanent cure of the ear affection cannot be effected so long as the exciting cause of such attacks remains in the naso-pharyngeal tract. The Eustachian tube, if diseased, should be the subject of proper measures to render it permanently patulous and healthy. The air-douche by the Politzer airbag or the compressed-air apparatus is sufficient in many recent cases to cause absorption of secretions in the middle ear and the reduction of hyperæmia and swelling of the mucous membrane. By this means the natural ventilation of the tube and tympanic cavity is effected and the drumhead is restored to its normal position and tension. This inflation should be carried out daily until the improvement obtained at each visit remains permanent until the next; then the time is lengthened to two, three, or four days or more, or a week or two between the treatments, according to this rule, until the cure is complete. As soon as the organ is apparently restored to its normal condition treatment should be discontinued, as a retrogression may otherwise occur. Overtreatment is certainly to be avoided. At each sitting the inflations are repeated from two to four or six times, with not enough pressure to cause pain or bright redness of the membrana flaccida. The vessels along the upper portion of the handle of the mallet often become injected even after gentle inflation.

For the removal of the fluid contents of the tympanic cavity that do not disappear after inflation, a number of years ago the author devised a method that he has never seen mentioned except once, which was in a journal article that appeared about three years following his publication. The patient inclines his head forward and a little toward the opposite side, and practices an experiment that just reverses the Valsalvan method. He closes the nose with his thumb and forefinger and draws the air from the naso-pharyngeal space down into his throat. This method exhausts the air of the cavities above the pharynx and sucks the secretions from the Eustachian tube and middle ear into the throat; they can be seen immediately afterward trickling down the side of the pharynx from the region of the tube-orifice. When the drumhead was perforated I have utilized this same method to draw medicated solutions from the external meatus through the middle ear and tube into the pharynx or nose. This thoroughly washes these surfaces with the remedies used.

Many cases do not require the use of the catheter. The inflator (Fig. 134) will inflate the middle ear in almost every instance in which it is properly employed. This saves the patient suffering, prevents injury to the inflamed walls of the tube, and avoids the possibility of infection, as the inflator is not carried into contact with the mucous surfaces as the catheter is.

If my method of auto-aspiration of the tympanic cavity through the Eustachian tube should not suffice on account of the thick, tenacious character of the secretion, paracentesis of the drumhead should be made under antiseptic precautions, as already described in the treatment of acute inflammation of the middle ear. After opening the membrane, air is thrown through the tube and tympanum so as to eject all discharges from them into the external meatus. There need be no fear that any permanent damage may be done by the paracentesis, for it will undoubtedly close in a few days. The expelled secretions should be removed by cotton on a carrier and the canal left dry. The meatus is then closed with absorbent cotton. Should fluid accumulation recur the membrane may have to be reopened, even repeatedly in exceptional cases. A few days or weeks of this treatment generally suffice for a cure, but the more obstinate conditions require months for their eradication.

The treatment for associated rhinitis and pharyngitis will be found under those headings.

Medicinal applications may be advantageously employed when simple air-douches fail to reduce the tumefaction and hyperæmia of the lining tympanic membrane. A number of years ago the author introduced the use of purified liquid vaselin, and later camphor-menthol in lavolin, for treating tubal and tympanic catarrh. The physiological action of camphor-menthol is given in Chapter I. Sprays of these remedies are thrown into the tube and middle ear by means of the improved inflator. The sponges it contains are saturated with the liquid and, by applying the cut-off of the compressed-air tube to the inflator, a jet of the remedy is projected into the tube and tympanum. I have since learned that Charles Delstanche, of Brussels, preceded me in the use of liquid vaselin in the middle ear. This treatment is usually best followed by the massage otoscope in obstinate cases. After the treatment has effected all that is possible we have observed that patients maintain their improvement and even continue to progress, after changing their residence from low and damp surroundings to a high, dry, and equable climate.

Operations on the drumhead are treated of in Chapter XXXVII; and hygienic measures are considered in the treatment of acute rhinitis, or coryza.

CHAPTER XXXVI.

DISEASES OF THE MIDDLE EAR *(Continued)*.

ADHESIVE INFLAMMATION OF THE MIDDLE EAR.

Synonym.—Sclerotic tympanitis. The term sclerosis is objected to by some writers, but it is retained because of our need of a brief, well-understood name.

The line of demarkation cannot always be distinctly and unmistakably drawn between the early adhesive and the late hypertrophic middle-ear catarrh. The latter may merge by imperceptible degrees in the adhesive variety, and the sclerotic processes may pass through their initial stage during the activity of the hypertrophic inflammation. But the most intractable forms of deafness—involving ankylosis of the ossicles, especially immobility of the stapes, and labyrinthal involvement—characterize the adhesive, or sclerotic, catarrh.

Pathology. — While this form of catarrh may affect the whole lining membrane of the middle ear, it may be circumscribed and limited to the tissues surrounding the oval and round windows. A distinguishing characteristic is an insidious interstitial inflammation, induration, and chronic thickening of the tissues, or sclerosis. But in a considerable proportion of cases there is progressive atrophy; pale, thin membrane, and calcareous degeneration. Again, there may be an excessive proliferation of connective tissue, filling and even obliterating the cavity of the attic and of the oval and round fenestræ and binding down the ossicles to such a degree as to impede or prevent their normal movements. Bands connecting the membrana tympani and ossicles together alter the normal tension of the conducting apparatus, resulting in varying degrees of deafness and perversion of hearing. These bands become the seat of calcareous degeneration, with the result of binding the ossicles to each other, to the membrana tympani, and to the tympanic walls with rigid or bone-like bridges. The drumhead is often the seat of these chalky deposits, which generally appear like miniature drifts of snow in crescentic forms below and about the mallet (Fig. 156 and Plate VIII).

Ankylosis of the ossicles takes place either by increased fibrous-tissue formation or by bony growth. Ankylosis is infrequent between the anvil and stirrup, but is frequent between the mallet and anvil, and between the stirrup-plate and the border of the oval window. Indeed, we may have these ankyloses combined with bands of adhesions binding the membrana tympani and ossicles together, and hypertrophy and calcareous degeneration of the membrane of the round window. The natural filaments and bridges of mucous membrane connecting the crura of the stirrup with the border of the oval foramen (Fig. 157) favor the fixation of this bone when fibrous or calcareous changes occur. Calcification or ossification may take place in the ligamentous ring of the stirrup, and bony union with the oval window may result. Calcareous deposits have been found in the malleo-incudal joint, and I have suspected that in patients of a uric-acid diathesis deposits of urate of soda might take place in these joints as well as in other articulations. Richey believes sclerosis to be closely related to progressive arthritis deformans. In a conversation with Professor Politzer upon this subject, the author asked him if he had ever discovered such a deposit, but he replied that he had not, since, in his method of preparing specimens, any evidence of such deposits would be destroyed. Christopher J. Colles believes that a rheumatic, gouty diathesis has undoubtedly much to do with the obstinate character of many cases of middle-ear trouble, especially the chronic middle-ear catarrh.

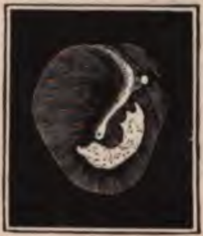


Fig. 156.—Semilunar Chalky Deposit in Front of the Handle of the Mallet. (After Politzer.)

"J. Habermann has observed that a slight degree of hyperostosis of the promontory and of the inner tympanic wall, leading to a positive closure of the niche of the round window, is induced by a chronic inflammation of the middle ear." ("American Year-book," 1902.)

The Eustachian tube may participate in a diffuse form of this inflammatory process and become stenosed, but it is often normally permeable and even abnormally patulous.

Etiology.—The hypertrophic, or secretive, inflammation of the middle ear undoubtedly predisposes to the adhesive or dry sclerotic form. The latter is noticeably hereditary and can be often traced to the father and his family or to the mother and hers. The brothers or sisters are often more or less afflicted. General diseases that are destructive of tissues and exhausting to the general strength promote this form of middle-ear catarrh. Chronic catarrh of the nose and throat and excessive indulgence in alcohol and tobacco-smoking bear a close causative relation to sclerosis. Yet the writer cannot place the emphasis on smoking that some authors do, since he has seen the worst examples of this disease in both women and men who were not at all addicted to the use of tobacco.

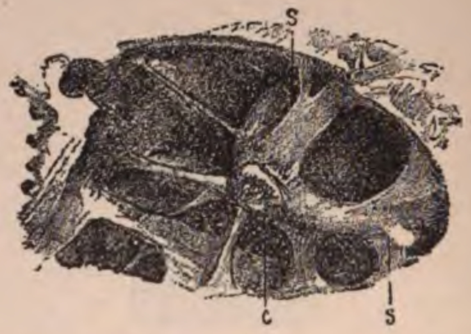


Fig. 157.—Niche of the Fenestra Ovalis, with the Crura of the Stapes, in the Normal Ear of an Adult. (After Politzer.) Network of bands extending from the neck of the stapes to the walls of the niche. *c*, Head of the stapes. *s*, *s*, Crura of the stapes.

The hypertrophic form might be spoken of as a disease of childhood, during which it is very common; but sclerosis is a disease of middle and old age. In my experience it nearly always is seen in persons over 30 years of age, rarely in those younger, and usually in those much older. It generally affects both ears, and, although patients in the early stage often aver that only one ear is troublesome, the surgeon should never fail to examine both—and the naso-pharynx as well.

Symptomatology. — Tinnitus aurium constitutes the most distressing symptom. Patients often declare that if the noises only can be conquered they will be satisfied, whether their hearing can be improved or not. These are variously described as high-pitched ringing, like that produced by quinine or by boxing the ears; like roaring or rushing of waters; chirping of crickets; hissing; the singing of a tea-kettle; escaping steam; sighing of the winds, etc. The intensity of the tinnitus is usually in proportion to the loss of hearing, until the miserable subject can hear little or nothing but the interminable storm of confusing and crazing noises, compared to which the clanging and crashing of the kettle-drums and cymbals in a Wagnerian overture are a heavenly melody.

The suffering is increased by cold, wet, and windy weather, taking cold, alcoholic drinks, speaking or reading aloud, and anything that produces excitement or depression of the strength or spirits. Sometimes a startling loud sound rings out suddenly, without any apparent cause, like that produced by a stroke from a hammer on a high-pitched bell; then gradually it dies away until it is lost in the confusion of other less intense subjective sounds. Often patients declare that the noises are not in the ear itself, but refer them to the side of the head and even to the occiput. Most frequently, however, the author has noticed that they place the tips of their fingers over the hearing-centre in the brain when locating the sounds outside of the ear. They sometimes believe it is possible for others to hear these noises if the observer's ear were to be placed close to their own. I have known some patients to insist that crickets or other creatures were in their ears, and that they must be removed, when the sounds were entirely subjective.

On the other hand, persons with discipline of mind and strong will suppress mentally these besieging enemies of consecutive thought and intelligent action until they are scarcely conscious of their presence while engaged in active occupations. But when the mind becomes disengaged for a time in a quiet place, or more especially when there is occasion for listening intently to a speaker, the noises seem to surge back into the presence of the conscious mind with furious intensity. Very nervous individuals are so overwhelmed by this symptom that they may succumb and part with their reason.

Severe or continuous pain is not a symptom of sclerosis, but sharp, stinging pains lasting but a few seconds or minutes are not uncommon. Great sensitiveness to certain sounds and to concussions of the air exists. The slamming of a door may be painful, owing to the noise or to the concussion, or both. With abnormal tension of the sound-conducting apparatus and impaction of the foot-plate of the stirrup in the oval window, there is an increase of labyrinthal pressure and more or less headache, vertigo, and sense of tightness or pressure in the head, although the patient may not be able to particularize or localize it unless he possesses a very observant mind.

The hearing is generally much worse in sclerosis than in hypertrophic catarrh, and shows less variation either with or without treatment. The hearing may vary during the day. One individual hears better in the morning and worse in the evening. Another hears better until, perhaps, 4 o'clock in the afternoon, when the hearing becomes dull, to remain so the rest of the evening. Another hears worse in the morning until he has his breakfast and boards the train for the city, when the jar of the car appears to produce a commotion in his ears, his Eustachian tubes open to the admission of air to the tympanic cavities, and at once he hears better and experiences a sense of clearness and relief in his ears. In the noise he hears better, even better in some instances than those with normal hearing. A locomotive engineer under my care said he could hear better than his companions when his engine was in motion, and that his employers, for whom he had worked several years, did not suspect his impairment of hearing. He managed to give them no opportunity of conversing with him except in a noise. The vibrations of his engine communicated motion to his conducting apparatus, which then conveyed sound-waves that were too feeble of themselves to institute movements.

Another interesting fact has come under my observation. A long-standing catarrh of one ear had so impaired its usefulness that the patient did not consciously depend upon it. The better ear had lost its usefulness through an attack of epidemic influenza, when the patient was obliged again to depend on the previously worse ear. Then it was found that, although sounds could be distinguished in it, they could not be understood. Words could be heard, but not interpreted, on account of long disuse of the organ. It became necessary to practice with the various words in common use until they could be distinguished from each other and correctly interpreted. The process was comparable to learning a new language, but it was accomplished.

In this case the sounds of the C and C′ forks, 128 and 256 vibrations, were perceived by air and bone conduction at the correct pitch by both ears. The C″ and C‴, 512 and 1024 vibrations, were always heard at the proper pitch with the right ear, and by bone with the left ear; but by air with the left they were perceived as a half-tone above the real pitch. Fork C⁗, 2048 vibrations, was heard with each ear faintly, when almost touching the mouth of the meatus, but not by bone-conduction with either ear. The patient distinguished with difficulty between this fork and the subjective ringing, which was of the same pitch.

The hearing for speech is the most affected, while hearing for music, etc., may remain fair. The musical composer, Emerson, was afflicted with greatly impaired hearing for speech; but he mastered the trying requirements of a great musical conductor. Hearing better in a noise, paracusis Willisii, is characteristic of this form of ear disease. By the simple expedient of causing sound-vibrations in the air by means of such a device as an electric hammer, or an electric bell with the gong removed, or a spring and ratchet in an electric motor or fan, one with this form of deafness may be able to conduct a business conversation when otherwise he could not without a conversation-tube or horn. It is not, however, the commotion of the air produced by the fan-wings that aids hearing, but the sound-waves that keep the drum-membrane and ossicles in vibration.

Bone-conduction is not so likely to be normal in this as in the hypertrophic process. It is often much diminished or altogether absent for the highest and lowest notes. But it should not be forgotten that bone-conduction begins to show reduction after the thirtieth year. The hearing for the highest tones and the very low notes is diminished or lost in the order named. Certain notes in the median register may also be unperceived, which indicates labyrinthal implication.

Diagnosis. — The appearances of the drumheads vary greatly. There are thickening and retraction of the membrane (Figs. 158 and 159 and Plate VIII) with foreshortening of the mallet-handle in some cases (Fig. 155), while in others there is atrophy with chalky deposits, or, in other instances, a membrane of quite normal appearance. The adhesive process may be confined to circumscribed areas on the surface of the inner tympanic wall which inspection does not reveal. The Eustachian tubes may have been involved during the early stages, while later in the history of the disease they may be freely permeable. The massage otoscope will show any adhesion of the membrane to the inner wall (Fig. 160) and the amount of mobility that the mallet may have lost. It will also reveal bands of adhesion that may exist superficially behind the drum-membrane if the latter is pressed by the air inward so as to lie against and embrace these bands. When there is normal freedom of motion of the hammer during the massage, it is certain that its articulation with the anvil and the articulation of the latter with the stirrup cannot be ankylosed; but the stirrup may be ankylosed in the oval foramen. In such cases, with a normal-looking drumhead, one must be very guarded in his prognosis, for they are sometimes intractable and hopeless.

Prognosis. — From what has been said it will be naturally inferred that brilliant results may not be expected from treatment in a large proportion of cases of sclerosis of the middle ear. The outlook will be more favorable if the disease is not of long standing, if tinnitus is either absent or only an occasional symptom, if the hearing is not seriously impaired, if bone-conduction is normal, and if treatment produce a decided amelioration of the symptoms. The reverse of these circumstances renders the prognosis unfavorable. Age, general health, sanitary surroundings, personal habits, heredity, and occupation must also enter into the account.

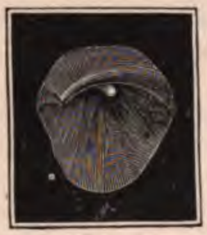


Fig. 158.—Marked Retraction of the Drumhead. (After Politzer.)

Treatment.—We can hardly speak of treatment in this form of middle-ear catarrh as being generally curative. We must candidly admit that in otology, as well as in other branches of medicine, there are cases that will sometimes baffle the most skillful practice of our art. All that we can hope to accomplish is to stay the progress of a persistent process. A patient who was formerly under my treatment said, when informed that he had lupus: "Then I will have nothing done." I replied: "If a wolf were biting you, would you not want me to take him off?" So in the present disease it is our duty to interpose every possible obstacle to the development and progress of the pathological process that is attended with such distressing and deplorable results. If no more can be accomplished than to relieve the never-ending din of harassing noises that incessantly bombard the brain, it is worth the while. This confusing strife of discordant sounds, this concentration of all the overtones in nature focused on a sensitive being almost deprived of normal, intelligible, sweet-toned sounds, often test the tension of the mind to the breaking-point.

The most common and simple treatment is the injection of air; but, in order to accomplish enough movement in the membrane and ossicles to stretch or break bands of adhesions and to overcome ankylosis, more force must be applied than is recommended in the simple hypertrophic catarrh. While the latter may require with a patulous tube no more than 8 or 10 pounds, or less, we have employed 60 pounds and even more pressure without producing much impression on these old, hardened, thickened, leathery drumheads. This is not mentioned as an intimation to the unpracticed that they should use so much pressure, but 20 pounds' pressure is often required in this affection to produce any motion in the ossicles. Würdemann advocates similar treatment, with the air-regulator. When the foot-plate of the stirrup is not ankylosed, some transitory giddiness may be occasioned by this pressure, but in case it is immovable we do not look for dizziness to occur from inflation. If we can obtain sufficient movement in the stirrup to produce momentary vertigo it brightens the outlook, for it probably indicates that bony union has not yet taken place between the base of the stirrup and the border of the oval foramen. If inflation and massage are followed by an amelioration of the symptoms, improved hearing, abatement of the tinnitus, relief of a sense of pressure, and a feeling of clearness in the head, then the prospect is encouraging. If a few weeks of daily treatment should make no perceptible impression of any kind, the opposite is true. But

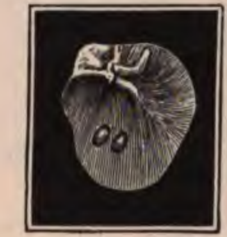


Fig. 159.—Circumscribed Depressions in the Antero-inferior Quadrant of the Left Drumhead. (After Politzer.)

the massage treatment on alternate days is a most important auxiliary to politzerization, and we can now profitably enter into its detail.

The author's massage otoscope (Fig. 114) possesses some advantages over others. As compared with Siegle's pneumatic speculum, the author's otoscope is (1) self-illuminating, not requiring the aid of a hand-mirror or forehead-mirror, the light being accurately focused on the drumhead; (2) it affords a magnified view of the field; (3) it can be operated in a smaller canal than will admit the speculum; (4) the bright reflection of light into one's eye by the glass of the speculum, the black background of which converts the glass into a mirror, is avoided in the otoscope by the proper and unvarying relations and the color of its various parts. The directions for manipulating this instrument are given in Chapter XXIX.

By alternately rarefying and condensing the air in the auditory meatus the amount of mobility in the drumhead and the chain of bones may be determined under brilliant illumination and a magnified view. If ankylosis of the joints of the ossicles, or if bands of adhesions between the bones and the walls of the tympanum exist, the handle of the malleus will be seen to be impeded in its movements, or it may remain fixed, while the membrane about it may be quite flaccid, and respond to the rarefaction of air by bulging outward about the mallet-handle (Fig. 151). When the membrane is greatly thickened in patches or contains calcareous deposits, these portions will be seen to resist the action of the vibrating column of air, while normal parts and areas of thin, cicatricial tissue that indicate the locations of former perforations may respond readily to the experiment. In cases where the drumhead is very thick, or where the ossicles are bound down by adhesions to the walls of the tympanum, no perceptible movement may be obtained at first, but decided improvement often follows a persistent use of the pneumatic treatment.

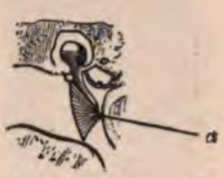


Fig. 160.—Circumscribed Adhesion of the Membrana Tympani to the Promontory Underneath the Handle of the Mallet. (After Politzer.) *a*, Point of adhesion.

It is our usual practice to continue massage with the pneumatic otoscope not longer than from one-twelfth to one-third of a minute at a time. A longer massage may carry the stimulating effect on the circulation to the point of irritation or congestion of the drum-head. If the movements of the membrane are painful, the massage is discontinued, and we never use this instrument during an acute otitis media. The patient must be warned against any movement of his head during the massage, since, if he jerk his head away from the instrument, it may produce a violent suction of the drumhead outward and result in pain, congestion, and rupture of blood-vessels. The discomfort of pressure of the rubber-tipped funnel should be distinguished from pain caused by movements of the membrane and ossicles.

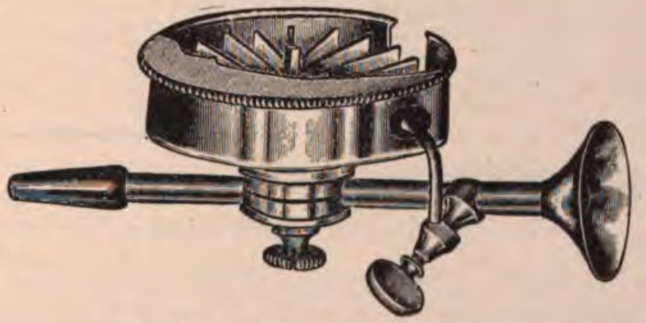


Fig. 161.—The Intratympanic Masseur.

As a counterpart to the massage treatment with the otoscope, the writer has practiced a method of intratympanic massage, for a long time, in the following manner: When inflating the middle ear with air, vapors, or fluids, the air-current entering the inflator, vaporizer, or catheter is interrupted by means of operating the valve of the cut-off with the thumb. In this manner the current may be interrupted about three hundred times per minute, if desired. While the author never knew of this method being used by any other before him, it is quite natural to suppose that it has occurred to others, and for that reason he claims no priority to putting the principle into practice.

W. H. Weaver has devised an intratympanic vibrator (Fig. 161) which has given excellent results in the writer's practice. The current of air is interrupted by means of a wind-wheel, and it is attachable to the inflator, catheter, or vaporizer. (*The Laryngoscope*, November, 1899.)

"Suarez de Mendoza has found the application of pneumomassage to the ear for fifteen or twenty minutes at a sitting has the best effect upon tinnitus aurium." ("American Year-book," 1902.)

In obstinate cases the progress may be hastened by making pressure directly upon the processus brevis by means of a probe covered with a soft-rubber tip or Lucæ's pressure-probe. Stiffness in the joints may be overcome in this way so as to facilitate the action of the otoscope. One should press gently on the process until the handle moves, then retract the probe until the malleus resumes its former position, press again, and so repeat the movement three or four times. Then the pneumatic principle of the otoscope should be applied until one is satisfied that the advantage gained will not be lost. The mallet should be moved until the patient experiences a sensation of movement or sound. The utility of passive motion, or massage, in the treatment of stiff joints and atrophied tissues is well recognized in general surgery. The application of the same principle to the same conditions in aural surgery is also attended with beneficial results. Charles Delstanche, of Brussels, has also invented an excellent massage instrument.

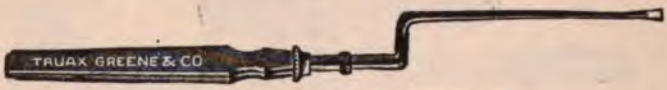


Fig. 162.—Lucæ's Pressure-probe.

The pressure-probe which I devised in 1886, and which was described at the meeting of the American Medical Association in 1888, has been superseded by a much better one (Fig. 162) invented by my good friend Professor Lucæ, of Berlin. It consists of a delicate shank set parallel to its hollow handle by a right-angle deviation, so as to bring the operator's fingers out of the field of vision. The distal extremity terminates in a cup lined with soft fibre that fits over the short process of the mallet. The handle contains a delicate spiral spring surrounding the proximal end of the shank so that pressure on the short process and release of pressure should produce a rebound or to-and-fro excursion of the hammer-handle without removing the cup from the process. This method is painful and causes congestion of the membrana flaccida, but is often beneficial. Direct pressure on the line of the short process is the most effective on the stirrup. If treatment by inflation and massage produce redness along the malleal plexus of vessels, and extending over the greater part of the membrana flaccida, it should not be used further during that treatment.

We have found the best results from a systematic plan somewhat as follows: For the first week or two lavolin is injected into the middle ear by means of the improved inflator (Fig. 134) on Monday, Wednesday, and Friday, always preceding the ear treatment with the necessary cleansing and medication of the nose and throat. On the intervening days the massage otoscope is used sufficiently to obtain as nearly as possible the normal mobility of the ossicles, or until the hyperæmia, mentioned before, is produced. On the second or third week the treatments are gradually separated by intervals of from two to four days. The lavolin conduces to the softening and rendering pliable the adventitious tissues in the middle ear. When stimulation is desired, or the patient or surgeon is in doubt as to the entrance of the jet of lavolin into the tympanic cavity, 6 or 10 drops of sulphuric ether added to the lavolin in the sponges contained in the inflator will produce stimulation and a sensation of coolness followed by a glow of warmth in the ear, thus demonstrating its presence in the tympanic cavity. Richey advocates the iodine-vapor inflations and iodized cotton in the external canal. Dundas Grant uses a self-inflator charged with chloroform.

If it should be desirable to produce the effect of camphor-menthol on the lining membrane of the tympanic walls without carrying a perceptible amount of the menstruum into the cavity, this can be accomplished by substituting the vaporizer (Fig. 125) for the inflator, with a 3-per-cent. solution of camphor-menthol in lavolin. For the physiological action of camphor-menthol see Chapter I. It is but proper to remark that the beneficial results sometimes afforded by this method are even more surprising to the surgeon than to the patient.

Formerly the author followed in the footsteps of his predecessors in the employment of vapor from resublimed iodine crystals with which to douche the middle ear, but so little perceptible good and so much irritation attended its use that it has had little place for this purpose in his practice for a number of years. Pilocarpine hydrochlorate, in 1- and 2-per-cent. solutions, is much used for injections into the middle ear through the catheter. Generally 6 to 10 drops of the weaker solutions are injected three times a week for four or six weeks. The medicine and catheter must be sterilized, and used while warm. These injections are best alternated with the massage treatment. The author has tried solutions of citrate of lithia, a very soluble form, by injections through the Eustachian tube, in the hope that if deposits of urate of sodium were present in certain gouty patients, and if the ankylosis of the ossicles were due to the presence of this deposit as in other joints of the same individuals, it might be dissolved out. Carbonate of lithia is known to accomplish similar results. The effect was *nil.*

A considerable variety of other solutions and volatile medicaments have been projected into the middle ear for this form of catarrh, but it would be a waste of time and space to enumerate most of them. Many are inert and others are positively harmful. The injection of fluids through the Eustachian catheter and tube is attended with irritation of the tube and tympanum unless accomplished by exceptionally skillful and gentle hands—and no others should attempt it. Possibly a little tympanic irritation may prove beneficial, but the probabilities are in favor of its proving harmful. If hyperæmia is desired it can more easily and safely be produced by the prolonged use of the massage otoscope and Lucæ's pressure-probe.

The Valsalvan method produces congestion of the tympanic tissues, and for that reason patients ought not to be taught or allowed to practice it. They receive a certain amount of temporary relief; consequently they practice it not once or twice a day, but repeatedly, many times a day, until the membrana tympani loses its tension, becomes relaxed and retracted, and no more relief is had. Such a case was lately under observation. He began practicing autoinflation ten years before coming under my care. He was advised by a prominent aurist to practice the Valsalvan experiment, and he has grown progressively worse during all that time. It is an interesting incident, which should serve as a warning, that he had been under the care of three aural surgeons, two of whom are eminent, without the fact of his being addicted to this habit being disclosed. This is only one example of numerous instances which could be cited as illustrating the unwisdom of placing in the hands of patients methods for self-treatment that are likely to result in more harm than good. The sole fact that the patient was worse after ten years of autoinflation is not mentioned as proof that the retrogression was due to the practice. The opinion is based on the results of studies of numerous cases, the details of which cannot be incorporated with this observation.

The use of the phonograph, vibrometer, and other expensive instruments that produce sound-waves of speech, or musical vibrations that are conveyed to the ears by rubber tubes inserted into the external canals, have been much vaunted by ill-advised laymen; but experimental investigation only confirms what a familiarity with the principles involved presages: their utter inutility. During a discussion of this subject at the meeting of the First Pan-American Medical Congress, the otologists present, including the distinguished Professor Politzer, concurred in these conclusions quite generally.

It is worthy of attention that the treatment with the improved inflator filters all the air and fluids before they reach the ear. All are forced through the finest quality of medicated sponges, which offer a resistance to the air-current of about four pounds. This fact should be given proper consideration in every treatment, and all the instruments must be kept scrupulously clean and sterilized in order not to commit the unpardonable sin of infecting a patient. A 5-per-cent. solution of carbolic acid is convenient for this purpose.

Massage of the external meatus has been a part of the author's treatment for a considerable time, although he has refrained from mentioning the method until convinced of its undoubted value. After observing the beneficial effects of massage on other organs it occurred to me to try the effect of the application of the same principles to the external auditory canal in the atrophic condition accompanying sclerosis. The result was not only that patients experienced a sensation of relief and freedom from itching, but the middle ear appeared to make better progress than when the massage was omitted.

The method pursued is as follows: Cotton is twisted quite firmly on the slender silver holder (Fig. 115) so that it will not easily slip off; this is smeared with vaselin or a 5-grain yellow-oxide-of-mercury ointment made with vaselin; then the anointed cotton is rubbed or stroked upon the canal-walls in a circular direction while the holder is rotated on its axis in the direction that will prevent the cotton from becoming disengaged. This friction is continued only long enough to thoroughly cleanse the skin and stimulate the circulation. The ceruminous glands, which are generally in an atrophied state in this disease, are aroused to greater activity. The skin, which is dry, scaly, and often eczematous, assumes a healthier appearance, and the effect upon the process of nutrition does not appear to be confined to the external canal, but seems to extend to the tympanic cavity.

Care must be taken to avoid touching or irritating the drumhead, and the cotton must not be allowed to slide off the end of the holder so as to allow the latter to abrade the skin. The author has not seen this method pursued or suggested by others, yet experience deprives him of the temerity to advance the claim to originality or priority.

How long shall treatment be given? Only so long as improvement continues. If treatment is protracted much beyond the time indicated, it may be followed by an actual retrogression. Too much treatment is pernicious. When improvement takes place and a state is reached in which the benefit remains stationary, despite all efforts for a reasonable time, then treatment had best cease. The patient should be discharged with proper instructions for the care of himself, and for his return should he begin to lose the gain already made. Indeed, these unfortunates must be gently, but candidly, informed that, so long as life's burden bears upon them, just so long they will suffer the necessity of repeating their journeys to the aurist whenever relapses occur. The invariable question "How long must I be treated?" every otologist has to encounter. The average length of time required varies from one to three months. Often the patient will remark that his head feels clearer and the noises have diminished or changed in character, which are favorable indications. If but one ear is affected, its early treatment may prevent the other from following in the same route. Or if both are affected, if they have not become too seriously involved, we may be able to arrest the progress of the disease and preserve, if not improve, the present state of hearing.

The application of the faradic current for ten minutes at a time daily for several weeks has appeared to exert a beneficial effect in certain cases. I have designed electrodes (Fig. 188) adapted to the concentration of the current in the ears, because the older ones diffused the electricity over the side of the head. The tips of the chamois-covered electrodes are wet and covered with a little moistened cotton, inserted into the auditory canals, and buckled in place. Then the cables connecting the electrodes with the battery are attached. In this manner the patient is relieved of the tiresome holding of the electrodes in place. However, we do not attach great importance to electricity in this disease.

CHAPTER XXXVII.

DISEASES OF THE MIDDLE EAR *(Continued)*.

OPERATIVE TREATMENT OF TYMPANIC ADHESIVE INFLAMMATION.

THE author has devised an ossicle-vibrator (Fig. 163) for the purpose of breaking up adhesions in the middle ear and ankylosis of the ossicles. It consists of a shaft of steel armed with two little levers at the distal end, and fashioned at the proximal extremity to fit into the angular handle of the middle-ear instruments. It is used in the following manner: An incision is made through the drumhead close to the anterior border of the hammer-handle and parallel with it from the short process to its tip under cocaine anæsthesia. Then the end lever, which is curved for the purpose, is carried through this slit and behind the mallet, when the handle falls between the two little levers. They are then slipped along upward, embracing the handle, until the stronger part of the bone is reached and the levers fit the handle somewhat closely. Now the retracted hammer-handle is slowly and very gently drawn upon until it is felt to move, or until the adhesions are felt to give way, and to the extent of bringing the handle to its normal position. The gentlest care must be taken or the adhesions may give way very suddenly with a jerk and the mallet might possibly be dislocated, or the handle might be fractured, especially if the instrument were allowed to slide downward upon the weaker portion of the handle. We have not known these accidents to attend the use of this instrument, but one can conceive that they are within the range of possibilities. Again, a patient has become pale just as the adhesions yielded to the traction, and nearly fainted. This was probably due to the disturbance of the intralabyrinthal fluid as exaggerated motion was effected in the stirrup. Some most remarkably beneficial

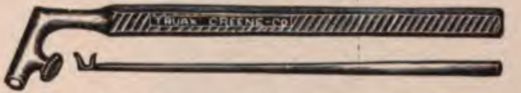


Fig. 163.—The Author's Ossicle-vibrator.

results have followed the use of this simple method of mobilization of the ossicles. No harm has been known from it. After making the incision and before introducing the vibrator, it conduces to the comfort of the patient to instill a few drops of a warm 8-per-cent. cocaine or eucaine solution.

Incision of the posterior fold of the drumhead is indicated when there is a great sinking inward of the membrane, with foreshortening of the mallet-handle, and exaggerated prominence of the short process, with a stretched appearance of the membrane about it. This condition, associated with serious impairment of hearing, and head noises that are unimproved by the treatment already detailed, calls for this simple operation. The section is best made about midway in the folds (Fig. 164) and the knife (Fig. 167, No. 2) is made to cut from above downward, with care that it is not carried deeper than is required to sever the fold. Otherwise the chorda tympani (Fig. 165) may be severed, producing paralysis of taste. Although the author has made such sections frequently, he has never known this to follow, but such results are reported. Patients generally observe a sense of relief from pressure, clearness in the head, diminution of subjective noises, and sometimes improvement in the hearing. In the class of cases in which we have principally practiced this operation we have not been able to follow up the results for years, but have known the benefit in a few to persist for several years. In others of a worse type the improvement has been transient.

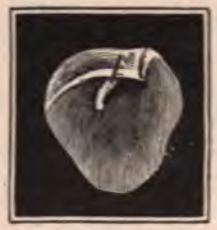


Fig. 164.—Section of the Posterior Fold of the Membrana Tympani. (After Politzer.)

Multiple incisions of the drumhead have proven beneficial in some instances. In 1886 the author reported the results of a series of cases to the meeting of the American Medical Association, from which we quote: "For the purpose of making a crucial test of the efficacy of this procedure, the writer has made it the last resort in those that afforded no real hope for relief from any other treatment. Perhaps the propriety of operating on those patients that seemed to promise no results might be questioned, were it not for the fact that in nearly all of them there was an unexpected improvement and that no unfortunate consequences followed the operation. The cases chosen to operate on were far more hopeless than those with chronic suppurative inflammation. The consideration that the former respond so little to our efforts, while the latter are so amenable to treatment with inflations, cleansing, peroxide of hydrogen, boric acid, bichloride of mercury, etc., with the result of not only arresting the disease, but of improving the hearing, has led me to seriously reflect upon the advisability of establishing the suppurative process in sclerotic inflammation of the middle ear. In a few cases only in my practice has this condition followed the procedure under discussion, and the results in the series of cases reported were satisfactory, especially when it is considered that they were the most unpromising and had proven the most intractable to the usual methods of treatment. But, as remarked above, this experimental work, which was carried out princi-

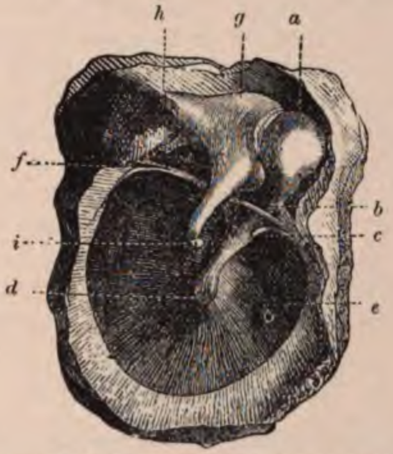


Fig. 165.—Internal Surface of the Left Membrana Tympani. (After Politzer.) *a*, Head of the malleus. *b*, Neck of the malleus. *c*, Tendon of the musculus tensor tympani and anterior fold of the membrana tympani. *d*, Inferior extremity of the handle of the malleus. *e*, Anterior portion of the membrana tympani. *f*, Chorda tympani and posterior fold of the membrana tympani. *g*, Incus. *h*, Short process of the incus. *i*, Long process of the incus.

pally in dispensary practice, did not afford opportunities to trace the results for a number of consecutive years. The simple incision, of course, closed in a few days, but the tension of the drumhead apparently was restored to more nearly the normal." Subsequently one of these cases came under my observation, showing that the really brilliant results obtained by this method had persisted for twelve years.

Another method that the writer has since pursued with considerable success was the excision of areas of the drumhead, usually triangular in shape (Fig. 166). Under cocaine triangular flaps were made with the apex above, then the attached base was severed, removing this piece of the membrane entirely. It was sometimes easiest, after incising the two sides of the triangle, to grasp the apex with delicate forceps in one hand while the base incision was made with the other. The improvement in some patients in whom there was no labyrinthal disease was very gratifying, and in private patients the possibility of maintaining the aperture for a considerable time was demonstrated. In one instance it had remained open a year and a half when the patient removed from the State. A peculiar experience was had with the other ear. The first operation afforded so much improvement that he requested that the same operation be performed on his right ear. It was done, and a slight, muco-purulent discharge followed, but soon ceased. While the discharge lasted, the hearing was considerably improved and the tinnitus relieved. After the discharge ceased the hearing began to diminish, when he expressed regret that the ear had not continued moist. This led me to anoint it with warm, pure vaselin, but when it was removed a few days afterward the very large perforation was entirely closed with cicatricial tissue.

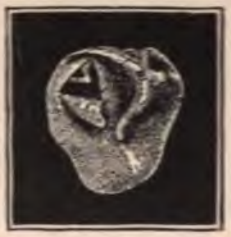


Fig. 166.—Triangular Resection of the Drumhead. (After Politzer.)

The removal of sections of the drum-membrane may prove otherwise advantageous. It affords accessibility to the tympanic cavity for the instillation of various remedies and the destruction of the adhesions, and it reveals whether the entire resection of the drumhead would improve the hearing. In case the membrane is so thickened and sclerosed and infiltrated with calcareous deposits as to preclude the possibility of its responding to any except extraordinary sound-waves, and the labyrinth is not involved, the opening of a window in the drumhead will admit sound to the stirrup and to the round window and prove whether the entire absence of the membrane would prove remedial. If the adhesive process has not ankylosed the stirrup in the oval window nor invaded the round window, vibrations can reach the labyrinth if the barrier to their admission be removed. The writer has employed this test to determine whether excision of the entire drumhead would afford successful results.

Division of the tensor tympani tendon is not much in favor among American aurists. The indications for it are not very clearly defined, and the appearances that suggest the shortening of this muscle—retraction of the membrana tympani and foreshortening of the mallet-handle—are also just as characteristic of the presence of membranous folds and bands of adhesion. The results of tenotomy have been either so unsatisfactory or so positively detrimental that the operation is not encouraging. Greene and Pomeroy operate preferably with a blunt-pointed knife curved on the flat to sever the tensor tympani.

EXCISION OF THE MEMBRANA TYMPANI AND OSSICLES.

This operation for ankylosis is a subject concerning which there is probably less unanimity of opinion among otologists than upon any other. While a few American aurists, especially Burnett, Sexton, Blake, and Jack, have been enthusiastic advocates of the operation, and some others have followed their lead for a time, the majority appear to have receded to a more conservative position. At the meeting of the section of Otology at the Tenth International Medical Congress, in Berlin in 1890, the Continental leaders in this specialty expressed themselves in very conservative terms on the subject. Several years ago the writer, through the columns of the *Journal of the American Medical Association,* invited all who had performed this operation to communicate the results to him for the purpose of publishing a collection of experiences that would afford a just estimate of the average value of this operation. The responses were so few and so unsatisfactory as to force the conclusion that the operation was either little practiced or was disappointing. There is probably little or no diversity of opinion concerning the utility of the operation in suppuration of the middle ear, especially when there is ossicular necrosis; but as practiced for ankylosis there has been so much division of opinion and sad, disappointing experiences reported during the past few years that candor requires that the subject be treated with reference to the ill as well as the good results. A number of cases have been under my observation upon whom the operation has been performed by surgeons both East and West, with the effect of producing a suppuration of the middle ear, destroying the hearing, apparently intensifying the noises, and producing more or less vertigo. The writer has had under treatment a physician from a far-western State whose ossicles were removed from one ear by a noted aural surgeon ten years before. All the ill results enumerated followed the operation, and, although the hearing was two inches for the watch before the operation, that ear has been totally deaf ever since, and the opposite ear has seriously deteriorated. This is a fair type of numerous similar instances that have come to my personal knowledge, and under the observation of other physicians who have been kind enough to report them to me.

Out of six cases operated upon by a young aurist, and reported by him at a recent meeting of Western specialists, the results were unfortunate in four. In one, which was under observation a number of months before, the operation was followed by total deafness, sanguino-purulent discharge, and facial paralysis that treatment failed to benefit.

B. M. Behrens (*International Medical Magazine*, May, 1897) reports his experience as follows: "Up to the present time the radical operation of removing the drumhead and malleus has been performed on 34 cases, of which 30 have given very little improvement or none whatever."

Würdemann had the courage to report several similar results at the meeting of the American Medical Association in 1892. It is worthy of mention that nearly all of these unfortunate cases were operated upon by specialists in eye and ear diseases; so that the results cannot be attributed to a want of familiarity with the subject. It is not our purpose to inveigh against this procedure as an operation, but to emphasize the necessity not only of the utmost precision and gentleness in operating, but also the most painstaking preliminary examination and experiments to determine the possibility or otherwise of beneficial results. For example, if the hearing-tests demonstrate that the labyrinth is involved in the disease, the inutility of the operation is established. If no improvement follow a resection of a portion of the drumhead so as to admit sound-waves to the fenestræ leading to the internal ear, no help can be expected from excision of the whole membrane. We do not lose sight of the fact that, by removing the drum-membrane and the two larger ossicles, we are afforded access to the stirrup so as to mobilize it. Some advantage certainly is to be conceded to this measure, although mobilization of the stirrup is not as simple an act as one might believe. Even with every vestige of the membrane removed, the stirrup is situated so high that a good view of it is difficult to obtain, and it is easy to dislocate when it is not ankylosed.

OPERATION FOR EXCISION OF THE OSSICLES.

The ear should be prepared by syringing with a warm solution of bichloride of mercury, 1 to 1000, and the instruments should be immersed for three minutes in boiling soda-water. For several years past the author has used ether to the exclusion of chloroform, instructing the anæsthetizer to administer only so much as is absolutely necessary to secure quiet and freedom from suffering. Cocaine anæsthesia is not as effective as ether. After removing *débris* of any nature from the canal, it is dried and closed with absorbent cotton until the operation commences. If ether is used, the patient must occupy a recumbent position. We have found it convenient to use tables of sufficient height to bring the patient's ear opposite the eyes of the operator while the latter is sitting (Fig. 206). A brilliant illumination is needed. We have generally used the Argand gas-lamp and light-condenser (Fig. 111) or the sixty-candle-power incandescent gas-burner. One will have a clearer view of the field of operation if the room is darkened so that no light penetrates the operator's eye except that reflected from the ear-cavity.

The instruments necessary (Fig. 167) are a paracentesis-knife (No. 2); a blunt-pointed bistoury (No. 1); two angular knives, right and left (Nos. 4 and 5); two ossicle-hooks, right and left (Fig. 168); a pincette (Fig. 169); a dozen slender cotton-carriers armed with cotton; a quart of hot, sterilized water, and a syringe.

The operation proceeds as follows: The drumhead is incised with knife No. 2 near the periphery, behind the short process of the mallet. Into this opening the blunt-pointed knife (No. 1) is inserted and carried first below, then sweeping the lower and the anterior attachments until the roof is reached; then this attachment is severed until the whole circular incision is completed, ending at the first entrance. The knife is best carried first from above downward, for the reason that less hæmorrhage is likely to obstruct the view than if the more vascular membrana flaccida were first cut. There is less hæmorrhage also if the knife is kept a little way from the periphery of the membrane. Now the angular knife is used to separate the articulation of the anvil and stirrup (Fig. 170). The anvil is extracted by aid of the hooked probe, and the attachments of the mallet are then divided, when it is brought away with the pincette. Stacke detaches the auricle and removes the integumentary canal first.

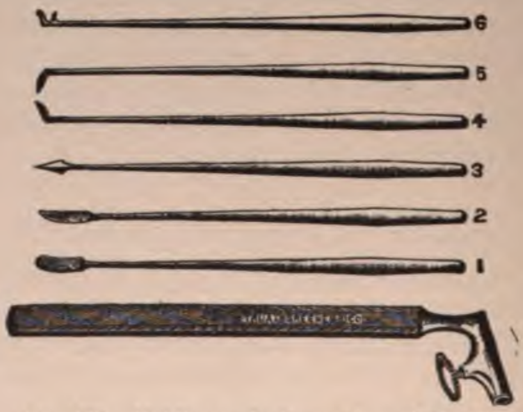


Fig. 167.—Middle-ear Instruments and Handle.

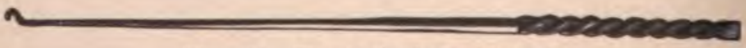


Fig. 168.—The Author's Ossicle-hook.

The operation is a very short one, requiring but a few minutes ordinarily if there is not much hæmorrhage or if the adhesions are not embarrassing. Rapid use of the cotton-carriers, which should be kept prepared by a nurse, will keep the field quite clear; but in case of considerable bleeding the syringe and quite hot, sterilized water or suprarenal extract can be used. It is difficult to avoid severing the chorda tympani in this operation, but the resulting paralysis of taste is of short duration. The ear-cavity should be dried after bleeding has ceased, covered with a layer of aristol from the small powder-blower (Fig. 144), and the canal closed with iodoform gauze. While there is considerable reaction in some cases, followed by discharges of a muco-purulent character, in others there is little or no disturbance. The patient should be kept quiet, and his diet restricted until healing takes place. By properly regulating the diet, both before and after the operation, there is less tendency to regeneration of the drumhead. The latter occurrence is quite frequent. In the case of the physician I have mentioned there is a false drumhead which we have not removed, for the reason that no possible good could come of it.

In another case of a very robust man from Kansas the writer removed the third adventitious membrana tympani, at his request. In the spring of 1893 a surgeon had removed his drumhead and mallet. In seven days after the operation he says the drumhead had been reproduced. This was removed, and in seven days more the surgeon said that another had closed the tympanum. A third operation was had, and in fourteen days another drumhead had formed. Two years afterward the patient came to me with the request that this remaining fourth drumhead with which nature had supplied him be removed. He suffered from great tinnitus and uncomfortable sensations of pressure, etc. Examination revealed labyrinthal involvement and the procedure was advised against. But, notwithstanding the assurance that no improvement was to be expected, the patient insisted upon the operation, with the hope that it might afford some relief to the tinnitus and pressure-symptoms. Therefore I re-

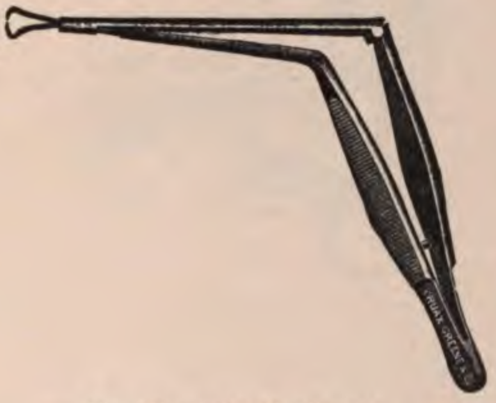


Fig. 169.—Politzer's Pincette.

moved the drum-membrane and anvil at the Post-graduate Medical School and Hospital, June 21, 1895, and cauterized the periphery of the drumhead so as to completely destroy the whole circular attachment. A few days afterward I found the stirrup dislocated, and removed it. No unfavorable symptoms followed; the membrane has not been reproduced, and the slight discharge following the operation soon ceased. The ear has remained in good condition ever since, but, although the patient imagined himself better, I could discern no improvement. The tinnitus and other symptoms were neither removed nor considerably improved. The patient thought he could hear, but accurate tests proved the contrary. This case is instructive in showing that thoroughly electrocauterizing the peripheral attachment of the membrane will prevent its regeneration. We do not often employ this cautery in the ear on account of the great heat generated in such a minute inclosed space, but other caustics have too superficial an effect to accomplish the purpose.

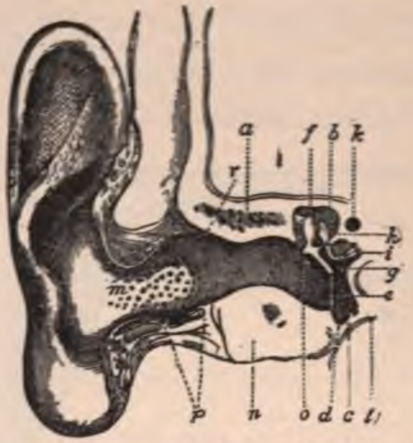


Fig. 170.—Vertical Section of the External Meatus, Membrana Tympani, and Tympanic Cavity. (After Politzer.) *a*, Cellular spaces in the superior wall of the meatus connecting with the middle ear. *b*, Roof of the tympanic cavity. *c*, Inferior wall. *d*, Tympanic cavity. *e*, Membrana tympani. *f*, Head of the malleus. *g*, Handle of the malleus. *h*, Incus. *i*, Stapes. *k*, Fallopian canal. *l*, Fossa jugularis. *m*, Apertures of glands in the external meatus. *n*, Inferior wall of the osseous meatus. *o*, Short process of the mallet. *p*, Fissures in the cartilaginous meatus. *r*, Junction of cartilaginous and osseous portions of the meatus.

The reference to these unfavorable cases—and I might cite others who have come under my care, one of whom was the most distinguished of American editors—is not for the purpose of condemning the operation itself, for I believe that these unfortunate results are attributable either to an unwise selection of cases or to unforseen accidents attending the operation. For example: Why should two inches of hearing for the watch be exchanged for total deafness, vertigo, etc.? What could have happened to cause destruction of the facial nerve? The results point toward an injury to at least one of the fenestræ opening into the labyrinth. But the reverse of this picture presents excellent and even brilliant results. Some cases that have proved intractable to the usual measures have yielded to this; but these are the ones in which the labyrinth has not been involved, and the adhesive process has not destroyed the usefulness of the stirrup and the membrane of the round window, and in which excision of a small section of the membrana tympani would demonstrate the possibilities of the operation. Barclay, Sexton, Burnett, Blake, and Jack favor excision of the ossicles. Gleason severs the incudo-stapedial articulation to improve the hearing in adhesive inflammation.

Mobilization of the stirrup has been practiced with favorable results, especially by Jack; but the crura of the stirrup are so exceedingly delicate and fragile that they are quite likely to break on applying side-pressure to them or on traction with the hook. This manœuvre is not in favor with otologists generally. After the membrana tympani has been removed for ankylosis the conditions are most favorable for mobilization. The probe can then be introduced alongside the stirrup and pressure exerted in all directions to break up adhesions and effect mobility. The hook can then be engaged in the apex of the converging legs of the bonelet and drawn upon until slight motion is had. But if the adhesion give way suddenly, the stirrup will be dislodged or extracted unless great care is exercised.

Excision of the ossicles for persistent suppuration is a common practice, especially in the case of caries and necrosis of these bones or of the walls of the tympanic cavity. Great cleanliness must precede these operations, which can more easily be performed under eucaine or a 20-per-cent. solution of cocaine than in dry catarrh. The writer has often operated under these anæsthetics without any difficulty, especially when the patients were possessed of considerable self-control. The same instruments and methods are employed as in the operation for ankylosis. If much curetting of the bone is necessary, a general anæsthetic (ether) had better be used.

Referring again to sclerotic inflammation of the middle ear, out of twenty-two cases of stapedectomy reported by Blake there was only one improvement, and in this the fixation of the stapes was not complete. Some became worse after the operation, both as to hearing and tinnitus. In five cases vertigo came on and persisted. Stapedectomy is now disapproved of by Blake, Cozzolino, and Gellé.

CHAPTER XXXVIII.

DISEASES OF THE MIDDLE EAR *(Continued).*

CHRONIC SUPPURATIVE INFLAMMATION OF THE MIDDLE EAR.

Synonym.—Chronic suppurative tympanitis.

This is a common sequel of acute suppuration and full of import to the afflicted patient. While the laity, and unfortunately certain members of the medical profession who are not well informed upon the consequences of the disease, minimize its importance and advise that it be let alone and that children will outgrow it, the patient's life may pay the penalty of its neglect. The disease may outgrow the patient. The close relations of the tympanic and cranial cavities ought to suggest to the mind of every thoughtful physician the importance of prompt and skillful interference with the progressive destructive ravages of a suppurative process. It is not self-limited; it does not tend toward resolution, but toward dissolution, and no trifling makeshift is pardonable.

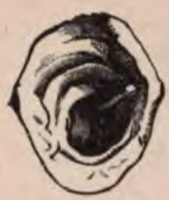


Fig. 171.—Extensive Destruction of the Drumhead. (After Politzer.)

Pathology.—The whole tympanic cavity is usually affected, the mucous membrane being hypertrophied and reddened, or yellowish and leathery in appearance. It seems unnecessary to remark that a perforation in the drumhead always exists, and in cases of long standing the opening is likely to be quite large and to afford some view of the interior of the cavity (Figs. 171 and 172 and Plate VIII).

The membrana tympani is rarely completely destroyed, and in those instances in which the destruction is quite extensive (Fig. 173) the membrana flaccida usually remains. The rupture of the membrane takes place most frequently in the lower posterior or anterior quadrant, but may be found in Shrapnell's membrane,—a very unfavorable location with reference to drainage. If the perforation appear above the short process of the mallet, we suspect necrosis of this bone. The instances are not infrequent in which the whole lower, or tense, membrane is destroyed, while the loose membrane from the short process upward is intact. The hammer-handle projects downward, free from any membrane except perhaps a border on each side of the upper half of the handle (Figs. 174 and 175). This gives an excellent view of the inner wall of the cavity and of the long leg of the anvil and possibly the leg of the stirrup if they are present.

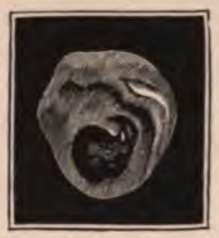


Fig. 172.—Pear-shaped Perforation of the Drumhead. (After Politzer.)

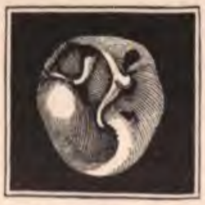


Fig. 173.—Perforation of the Posterior Half of the Right Drumhead. (After Politzer.) Behind the mallet is the projecting, yellowish-gray promontory; above it the long crus of the incus lying free and the posterior crus of the stirrup.

When the ossicles participate in the necrotic process, the anvil is the first to succumb in three-fourths of the cases. This is to be accounted for by its poorer blood-supply. Its nutrition is easily cut off by pressure in the upper part of the tympanum.

In long-standing suppuration, and more especially when the destruction of the drumhead is extensive, there occurs a shedding of superficial epithelium of the middle-ear membrane, which takes on an epidermic character; so that it presents the appearance of skin rather than mucous membrane. This probably is brought about by an extension or growth inward of the epidermis of the canal through the perforated membrane, and cholesteatoma may result.

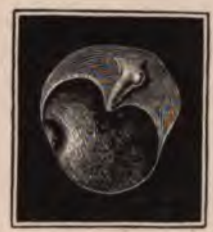


Fig. 174.—Destruction of the Inferior Half of the Membrana Tympani, Laying Bare the Promontory and Niche of the Round Window. (After Politzer.)

While the perforations of acute suppuration generally close spontaneously after the discharge ceases, they more often remain more or less permanently open after the chronic suppuration is cured. In a long course of suppuration the destruction of the membrane is far more extensive than in the acute or transitory variety. Yet we often come upon elderly people who show unmistakable evidences of extensive loss of tissue of the membrane that has been repaired by nature—large sections in the lower posterior or anterior quadrant, or in both, that consist of translucent, thin, cicatricial tissue, surrounded by the ashy-gray, leathery tissue of the old membrane. Many of these people are unconscious of ever having had a discharge from the ear,

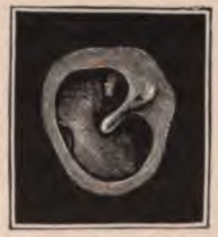


Fig. 175.—Large Perforation of the Right Drumhead. (After Politzer.) The handle of the mallet is free and the long crus of the incus and the niche of the round window are visible.

but upon investigation the fact may be established that it occurred beyond their remembrance, probably during childhood.

The disease may extend to the labyrinth, although it is not of frequent occurrence. It far more often invades the mastoid antrum and cells. If we recall the position of the antrum behind the middle ear, and the connection of these cavities by the aditus ad antrum, and then their relative positions when the patient lies upon his back, we shall appreciate how the fluids in the tympanum may drip through the aditus and enter the antrum (Fig. 220). It is like the changing of the battery-fluid from one part of a Kidder tip-battery cell to the other by turning the cell upon its axis. It is apparent from these considerations that mastoid disease is a logical consequence of middle-ear suppuration.

Etiology.—From what has already been said it is evident that this affection is only an extension of the acute suppurative process in most instances, the causes of which are enumerated in Chapter XXXV. Neglect of an acute disease generally results in a chronic one. A tubercular or syphilitic habit of body predisposes to this condition.

Symptomatology.—The presence of a purulent discharge issuing from a perforation in the drum-membrane is a simple matter to discern. The pus may be abundant or very scant. The author had under treatment a case of more than twenty years' standing in which not more than a drop or two exuded in a day. For a few days or a week there would be no discharge, and then a foul-smelling exudation was found. In other instances there is not enough purulent discharge to run out of the canal, but instead it dries in scales or yellow crusts on the walls of the canal. As these crusts of inspissated pus work toward the mouth of the canal they cause itching and consequent annoyance.

The hearing may not be seriously impaired. It does not deteriorate so generally nor to such a degree as in sclerosis. Still, the hearing is greatly affected in occasional cases. Crusts may form over a small perforation, obstructing the discharge and impairing hearing; but patients do not often complain of subjective noises.

Granulations (page 456) often form on the border of the perforation and over the surface of the intratympanic membrane (Fig. 176 and Plate VIII). Large, cherry-red, spongy granulations sometimes may cover the inner wall like a cushion. They are sensitive and bleed readily.

Polypi (page 456) occasionally spring from the membrane and occupy the canal. A single polypus often fills the canal and extends to its mouth. We have seen them grow to such proportions that the pressure upon the canal-walls interfered with the circulation in the end projecting from the mouth of the canal to the extent that its color was livid or black and suggestive of gangrene. We also have multiple aural polypi of luxuriant growth and of the form of a miniature cauliflower. These are usually of a bright-red color. If the pus in which the polypus is macerating is carefully removed without irritating the polypus,.the latter presents sometimes a very pale, exsanguinated surface, but upon friction it assumes a bright-red color and bleeds upon being touched. Mucous polypi are more commonly met with than the fibrous variety.

Carious bone (page 457) is to be suspected whenever granulations or polypi exist. The bent probe (Fig. 177) may detect denuded bone in the tympanic cavity. The anvil (Fig. 189) is occasionally lost, and, if the external wall of the aquæductus Fallopii, containing the facial nerve, is imperfect or necrosed, facial paralysis of the same side will occur if the pressure is sufficient, or the nerve itself may participate in the inflammation. William Sotier Bryant calls attention to the fact that there is sometimes a perforation in the outer bony wall of the aqueduct, establishing a direct communication with the middle ear. If necrosis of bone is present, the odor of the discharge is generally offensive, even when care is taken of cleanliness. With neglect of the discharge it may become very foul, even when there is no osseous necrosis. Invasion of the labyrinth is ushered in by sudden dizziness, deafness, and nausea. Fortunately this is a very rare complication.

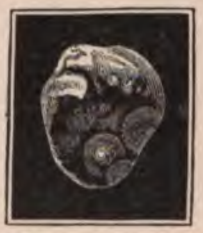


Fig. 176.—Destruction of Inferior Half of the Drumhead. (After Politzer.) Globular granulations on the inner wall of the middle ear.

Diagnosis.—If the description given be borne in mind, there is no difficulty in deciding upon a case of chronic suppuration of the middle ear. The long-standing discharge from a perforation in the drumhead makes the case clear.

Prognosis.—This is a progressively destructive disease. Its tendency is not to spontaneous resolution. While many attacks may appear to get well of themselves, as long as the diseased condition remains, just so long recurring attacks will succeed each other. With every fresh cold, back comes the flux. The disease continues, though no discharge may make its appearance for a time, and the patient is lulled into a false sense of security. A slight exciting cause sets up another exacerbation of the existing inflammation. Moreover, the natural tendency of this trouble is toward the bone. The mucous membrane of the middle ear answers the purpose of a periosteum, and the intimate relation of these structures jeopardizes the integrity of the osseous tissue when destructive processes are going on in the membranous lining. It has also been shown that mastoid suppuration is an offspring of middle-ear inflammation. The same may be said of phlebitis and sinus-thrombosis, meningitis, subdural abscess, pyæmia, and abscess of the brain. Only with proper treatment is the prognosis good.

Fig. 177.—Slender Middle-ear Probe.

Treatment.—More brilliant results are obtained here than in the adhesive catarrhal form of inflammation. The first object is absolute cleanliness. This is best obtained by syringing the ear with at least a quart, or more if necessary, of sterilized water, or mercuric bichloride solution, 1 to 5000, as warm as is comfortable to the patient. Unless a considerable quantity is used, all of the inspissated, greasy accumulation often found in a neglected suppurating ear is not removed. As much force as can be easily borne is generally required at the first cleansing, to remove all the discharges from the ear. The water need not be thrown with so strong a current as to produce giddiness or nausea. The continuous-flow syringe, like the alpha (Fig. 143), is the most satisfactory, as it admits of most perfect control over the temperature of the water and the force of the current. The stream is directed a little toward the roof of the canal, rather than directly in a line with its axis, so as to return along its floor. The patient, if an adult, can hold some conveniently shaped receptacle pressed closely against the side of the neck just beneath the lobule to catch the returning solution. The water once injected into the ear must under no circumstances be reinjected. We have found people (physicians!) committing that act. Crusts, inspissated pus, and cerumen not expelled by the water can be removed with cotton on the carrier or a blunt probe. Delstanche has devised a tympanic syringe to inject the attic. The writer has found the antrum irrigator (Fig. 64) very effective in washing out the attic and dislodging cholesteatomatous masses.

After cleansing thoroughly with the syringe, the ear is inflated (Fig. 134) so as to eject any possible secretion remaining in the Eustachian tube or middle ear. The parts are then dried with absorbent cotton, and a coating of aristol or nosophen (page 410) is dusted over the surface of the middle ear with the small powder-blower (Fig. 144), or boric acid with the large powder-blower (Fig. 178). Aristol is excellent on account of its antiseptic, anæsthetic, and cicatrizant properties. It never causes pain and does not interfere with the hearing by clogging the canal or impeding the movements of the drumhead and ossicles. If the discharge does not show perceptible decrease in the course of a week or two, it is advantageous to substitute boric acid for the aristol or to throw a coating of boric acid over the aristol dressing. This can be done without dislodging the latter, for it sticks tenaciously to the surface of the tissues. This adds the drying effect of boric acid to all of the excellent qualities of aristol, and constitutes an ideal treatment for such individuals as we have mentioned who have an idiosyncrasy against boric acid. We have met a few such instances with this disease, although they are oftener encountered among the acute cases. After the first few treatments of this

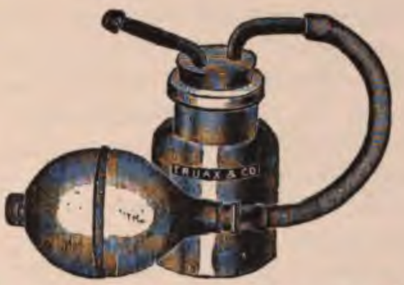


Fig. 178.—The Author's Large Powder-blower for Use with a Hand-bulb or Compressed Air.

kind it is advisable to resort to an entirely dry method, relying on the absorbent-cotton driers, inflation, and the powders, for cases often do much better with the dry than with the wet method. The discharges often cease after a few treatments, and occasionally after the first one. The results of painstaking methods are more surprising to the surgeon than to the patient, who may have been harassed for long years with annoying discharges.

One of the most effective methods consists in packing iodoform, or nosophen, gauze quite firmly against the suppurating surface if it can be reached, more especially upon a granulating surface. If the iodoform disagree, other medicated or sterilized gauze must be substituted. The dressings must be frequently repeated when the discharge is copious.

Many other remedies are commonly used, but it is the author's purpose to give only what years of experience have proven to be the most efficacious and to inform the practitioner upon the relative merits of those that have been given extensive trials. Some will be mentioned merely for the purpose of saving the reader's time in experimenting with the useless.

Iodoform in fine powder is useful when the odor of the discharge and other signs indicate the presence of dead bone; otherwise it is not preferable to aristol or nosophen, and its disgusting odor is usually very objectionable to fastidious people. The old-time remedy, silver-nitrate solution, was formerly extensively used in my clinics, but for years we have employed it but little. Having tried it in solutions varying in strength from 1 per cent. to a saturated solution, it became apparent that its remedial qualities in this disease were inferior to remedies that were less objectionable. The blackening of everything it touches renders it especially disadvantageous in private practice. Zinc sulphate exerts too little influence to merit our confidence. Salicylic-acid powder, highly recommended a few years ago, has proven, in my hands, a total failure in this disease. Moreover, the violent irritation of the nose and the attacks of sneezing which its unavoidable inhalation produces during the insufflation would preclude the possibility of its employment were it not otherwise impotent. Europhen proved unsatisfactory in this disease. We have persisted in experimentation with it alone and combined with aristol, and are forced to the conclusion that the total value of europhen-aristol lies in the latter ingredient. Indeed, the aristol alone is more potent. After extended trials with yellow pyoktanin no appreciable effect could be observed in arresting the discharge, and the same is true of dermatol, alumnol, and iodol.

Let us suppose now that we have a more intractable type of suppuration. The mucous membrane lining the tympanic cavity appears very red, suggestive of the glow of dull red-hot iron; it is much thickened and tumefied; the drumhead partakes of the same characteristics, is very sensitive to the touch, and shows rhythmical pulsations. These characteristics obtain in a small proportion of old cases. It is difficult to adapt the dry method of treatment to such conditions, for the touching of the drum-membrane with the cotton to absorb the discharges is productive of great pain. It is best then to irrigate and allow all the water to run out; then hydrozone, which is a stable 30-volume dioxide, or peroxide, of hydrogen (H_2O_2), is warmed slightly, only sufficiently to make it comfortable to the ear, and is used to fill the canal while the head is inclined to the opposite shoulder. Or, better still, the patient lies upon the opposite side. Warming the dioxide to the temperature of the body, or even ten degrees above, does not impair its efficacy, as we have often demonstrated. It is allowed to remain in the ear until effervescence ceases. This requires about five or ten minutes, according to the amount of pus present and the purity of the remedy. It must not have a strong acid reaction or it will cause pain, and it should contain not less than fifteen volumes of available oxygen. The hydrozone decomposes pus-corpuscles, during which action free oxygen is liberated to exert its germicidal property upon bacteria. Besides this the active effervescence that takes place dislodges the accumulations, and its mechanical action brings to the surface materials that even syringing fails to dislodge,—for example, aristol that may have remained from a previous treatment. This boiling out of the middle ear appears to cleanse the attic even better than the intratympanic syringe, and no unpleasant results have ever attended my use of it.

After removing all of the *débris* which has been dislodged by the hydrogen dioxide, the ear should be dried with tufts of absorbent cotton. Then a 12-per-cent. solution of carbolic acid in glycerin is instilled and allowed to remain in the ear about ten minutes. This penetrates deeply, disinfects, deodorizes, and anæsthetizes the tissues sufficiently to permit of its being replaced with a saturated solution of boric acid in alcohol, without producing pain.

The latter solution is particularly indicated when granulations are present, to shrink them. When this solution is allowed to run out, after remaining ten minutes or more in the ear, the boric acid which remains on the suppurating surface should not be removed.

F. C. Hotz reports excellent results from camphoroxol and mentholoxol. They consist of combinations of hydrogen dioxide and alcohol with camphor in the first instance, and with menthol in the second. The writer can confirm this report.

E. B. Gleason prefers a 5-per-cent. solution of protargol, which "is an astringent and antiseptic quite unirritating to the middle-ear mucous membrane." (*The Laryngoscope*, March, 1900.)

In suspected retained discharges in the attic or mastoid antrum, especially when the perforation is too small to admit of free drainage, it should be enlarged, as already described on page 406. But there are frequent instances in which the discharge does not diminish after thorough efforts at cleansing, disinfecting, and medicating. This may be due to the fact that the means employed do not remove all of the retained secretions, and there is a consequent failure of the medicaments to reach all of the diseased surfaces.

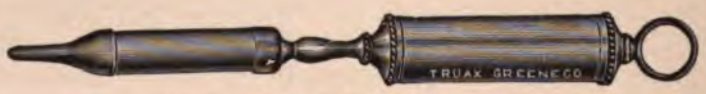


Fig. 179.—The Author's Ear-aspirator.

The author has devised an instrument to meet this condition. It consists of an improved miniature airpump (Fig. 179), containing a metallic valve that does not get out of order, fitted to a glass reservoir. The metallic tip of the reservoir should be covered with a section of soft-rubber tube so as to permit of its being fitted with firmness and nicety into the external meatus. Gentle traction on the piston-ring exhausts the air in the middle ear and accessory chambers and causes the ejection of any discharges within them into the canal, whence they are removed with the cotton absorbent. After the piston is moved the whole length of the cylinder once or twice the instrument is removed and the canal inspected. Then, after drying it of the secretions brought to view, the process is repeated two or three times. When no more discharges can be drawn from the hiding-places, it is safe to conclude that all have been evacuated. The traction need not be rapid nor strong enough to occasion discomfort or the exudation of any blood; although, if the latter occur, no harm is done, for the discharges are the more thoroughly swept away and the tissues are stimulated. The instrument is held in such a way as to grasp both airpump and receiver in the fingers of one hand at the same time, so as to prevent their being separated while the pump is in action. In order to prove the value of this simple device in numerous cases we have given the most thorough treatment by the old methods without diminishing the discharges, and then have resorted to this treatment in addition to the old methods, with the result of stopping the flux promptly. In such cases, after cleansing as much as possible by syringing, the use of dioxide; etc., we have applied the aspirator and have drawn an astonishingly large quantity of discharges that must, judging from their amount and character, have been stored in the mastoid antrum and cells, and these cases have recovered without mastoid operations. In some instances we have drawn out large masses of thick, cheesy deposits that were not within the range of vision before using the aspirator.

McBride opens the mastoid process and middle ear to cure chronic suppurative inflammation, and Jones advocates excision of the ossicles.

CHAPTER XXXIX.

DISEASES OF THE MIDDLE EAR *(Concluded)*.

SEQUELS OF MIDDLE-EAR SUPPURATION.

GRANULATIONS.

THE presence of granulations (Plate VIII) in the middle ear or on the drumhead protracts the cure of a suppurating process. If they are small and not very extensive, they can be made to shrink up and disappear by the use of alcohol and boric acid. At first it is advisable to dilute the alcohol one-half. In the event of no pain being caused by that it can be used stronger, and if the patient easily bear it the full strength should be employed. The period in the treatment for using it is just after the cleansing process is finished, and the alcohol should remain in the ear ten minutes or longer. After it runs out the granulations that appeared very red before its application are blanched to a pale-gray color after the contact with the alcohol for a sufficient length of time. Then the treatment should be completed with the powders, as described in Chapter XXXVIII. Tincture of iodine is effective when applied to the granulations by the cotton-carrier, only enough being used to touch each granulation, but not to run over the surrounding surface. When the granulations are very large and abundant, suggestive of beginning polypi, these are best removed by the curette (Fig. 191) under a warm, 20-per-cent. solution of cocaine or an 8-per-cent. solution of eucaine. The bleeding is stopped by pressing a pledget of cotton against the curetted surface for a few minutes, a few drops of cocaine solution is used on them, and then the alcohol as before. Chromic acid may also be employed as described in the next paragraph. In my experience the ear has seemed to be intolerant of the presence of suprarenal extract.

POLYPI.

Two forms of aural polypi occur: the mucous and the fibrous. Suppuration cannot be cured so long as a polypoid growth is present. This is best removed under cocaine or eucaine by a polypus-forceps

(Fig. 180) or the snare found in the middle-ear case (Fig. 181). It requires less skill to use the forceps. The polypus should be detached as close to the attachment of its pedicle as possible, and, the method being so simple and identical with the same procedure in other fields of surgery, it would be superfluous to enter into the details here. The bleeding ceases soon and can be stanched as described in treating of granulations. Then cocaine is applied and the attachment cauterized with chromic acid. The loop of the flexible caustic applicator (Fig. 182) is dipped into the dry crystals of chromic acid, and these are held over a small flame for a few seconds until they are melting. Just at the instant the crystals are fused in the form of a drop on the most convenient site of the loop for application the instrument is withdrawn from the heat and the drop of fused acid is blown upon to cool it suddenly into a bead. Unless the attachment of the polypus is well cauterized it is likely to grow again. It can be removed with a fenestrated curette of good size, like the larger one in the middle-ear set, by placing the curette so as to engage the pedicle in the aperture. Then, by pressing firmly against it and drawing outward, it is detached and extracted.

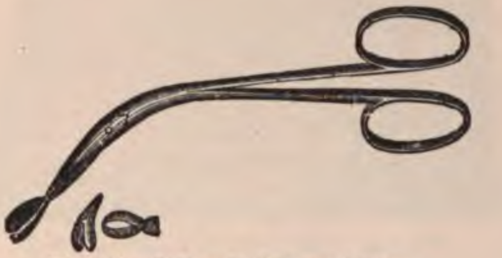


Fig. 180.—Politzer's Polypus-forceps.

CARIES AND NECROSIS OF THE MIDDLE EAR.

When the tympanic walls are denuded of their lining membrane, which is, in effect, its periosteum, the treatment requires much patience and persistence. After cleansing by water, hydrozone, and the aspirator, as already outlined, a 12-per-cent. solution of carbolic acid in glycerin is poured into the ear. This does not require warming. After it has remained long enough to produce the anæsthetic effect of the acid—about six minutes—it is removed and replaced by a saturated solution of iodoform in alcohol. If the solution is agitated so that some of the powder is held in suspension, so much the better, for when the solution is allowed to run out after five or ten minutes a fine coating of iodoform powder is left covering the diseased tissues. This solution penetrates the diseased cavities deeply. Then the treatment is completed, as already described, for suppuration. In cases where denuded bone could be felt with the probe, this method has effected cures. Indeed, sequestra of necrosed bone may have been cast off and discharged with the pus, leaving the healthy bone to become healed over by granulation. But if dead bone be present it acts as a local irritant similarly to a foreign body, and must be removed with the curette before healing will take place. A foul odor, notwithstanding scrupulous cleanliness in the treatment, indicates the presence of osseous necrosis. As long as this foul odor continues the discharge cannot be stopped, but the disappearance of the odor is a very favorable symptom, and indicative of a cure. Persistence in this treatment will often remove the odor and discharge. There are occasionally persons with whom the alcoholic solution of iodoform

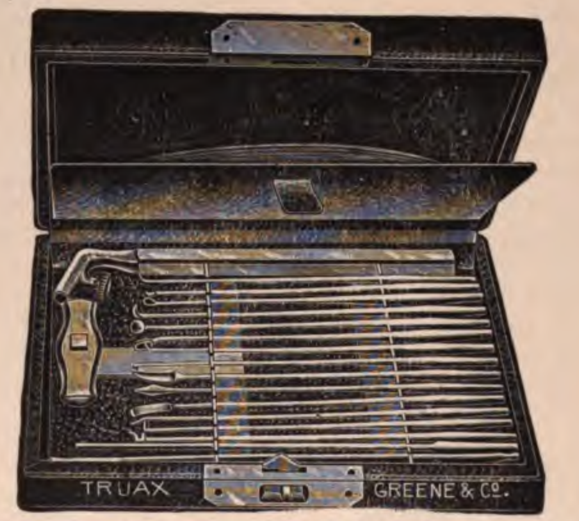


Fig. 181.—The Author's Middle-ear Case.

Fig. 182.—The Author's Caustic Applicator on Flexible Shank.

does not agree. The integument of the canal becomes swollen, tender, and excoriated, and the toxic iodoform must give way to other remedies. The bichloride of mercury occasionally is not well borne, and if used in too strong a solution a similar condition ensues, and even ulceration of the integument.

NECROSIS OF THE OSSICULA.

The anvil, the first to yield to the necrotic process, is sometimes lost before patients apply for treatment, but when it is present and is diseased it should be removed. The same is true of the mallet. In such cases they are of no value to the patient, and only serve to excite a continuation of the inflammatory process and to hinder the free evacuation of the retained secretions. Their excision, if skillfully accomplished, does not impair the hearing and may conserve it. The question of their removal in this instance is not a parallel case to that in sclerosis. The operation is described in Chapter XXXVII.

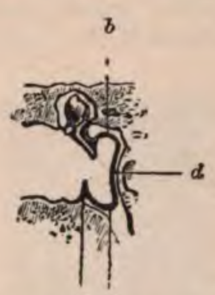


Fig. 183.—Vertical Section of Middle Ear; Drumhead in Contact with the Inner Wall. (After Politzer.) *a*, Ledge-shaped remnant of the membrane. *b*, *c*, The lateral portions of the cicatrix, extending from the remnant of the membrane to the inner wall of the tympanic cavity. *d*, Portion of the cicatrix applied to the inner wall.

Adhesions of the remnant or of cicatrices of the membrana tympani to the inner wall of the tympanic cavity may occur after the suppuration is cured (Fig. 183). The latter lesion results in a cup-shaped depression in the drumhead. Adhesions and false membranes also form within the tympanum, subdividing it into several cavities (Fig. 184). Connective tissue and chalky deposits (Fig. 185 and Plate VIII) sometimes completely fill the middle ear, imbedding the chain of bones so firmly that their functions are entirely destroyed. In case the adhesions cause serious impairment of hearing by embarrassing the vibrations of the ossicles or by preventing sound-waves from reaching the labyrinth, they can be divided or excised. Connective-tissue formations and cretaceous deposits can be treated like cholesteatomatous masses, which are considered later.

PERFORATIONS OF THE DRUMHEAD

Perforations (Plate VIII), if they are large, generally remain open and require no treatment. The edges become covered with a continuation of the epidermis of the drumhead. The membranous lining of the middle ear becomes habituated to the presence of air that reaches it directly through the meatus, so that it acquires a tolerance for it, like the nasal mucous membrane. The hearing remains better with than without the perforation, but there are exceptional instances in which the hearing is improved by closing the perforation with cotton or a thin rubber disc. The latter exceptions can be treated by freshening the edges of the perforation after the discharge ceases, and covering the aperture accurately with a moist disc of sized paper. The presence of this foreign body will excite sufficient irritation to increase the circulation in its vicinity to the extent of causing a proliferation of cells, growth of granulations, and consequent closure of the opening. But the cases are rare in which the patient's interest is best subserved by closing the perforation, for the remainder of the drumhead is usually opaque, hypertrophied, or calcified (Fig. 185) and leathery; so that it is unfitted for transmitting sound-waves. With an opening through it the vibrations have direct access to the foot-plate of the stirrup and the membrane of the round window, and through them reach the perceptive apparatus.

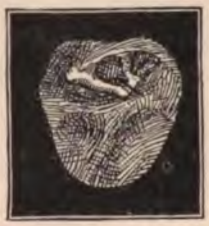


Fig. 184.—Band-like Cords between the Lower End of the Hammer-handle and the Stapedo-incudal Articulation. (After Politzer.)

Artificial drumheads should receive mention in this connection. We have seen a few persons who believed they were able to hear better with discs or cones of soft rubber inserted so as to lie in contact with the membrana tympani; but the remote ill effects more than counterbalance the immediate apparent increase in hearing-power. When there is suppuration they impede the outward flow and promote decomposition of the discharge. In any event, they act as foreign bodies, giving rise to irritation and resulting increase in connective-tissue formation. This increased thickening of the tympanic tissues insures a still greater decrease in hearing.

DEAFNESS FOLLOWING SUPPURATION.

Deafness following suppurative inflammation calls for treatment after the suppuration ceases. Politzerization to overcome adhesions between the ossicles or drumhead and the walls of the tympanum may be practiced three or four times a week. Better still, if the perforation has closed, is the method of throwing a spray of lavolin into the middle ear with the improved inflator (Fig. 134). The lavolin takes the place of the discharge, and it is commonly observed that the hearing is better while the middle ear remains moist. The lavolin is a bland, non-irritating liquid vaselin, and does not become rancid like oil. It softens the dried and hardened tissues, increases their suppleness, and promotes greater freedom of mobility. This injection is followed by the use of the massage treatment (Fig. 114). The drumhead is caused to make a score or more to-and-fro excursions, with an endeavor to approximate as nearly as possible the natural limits of movement. This is after the fashion of the machinist, who first oils his machine and then works it. This method

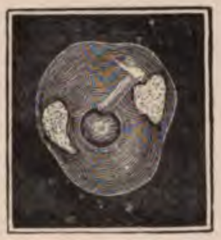


Fig. 185.—Central Perforation of the Drumhead and Calcareous Deposits. (After Politzer.)

is best pursued on alternate days for three or four weeks, or as long as perceptible progress is made in improvement, and then discontinued. As long as the benefit obtained is stationary the ear had best be let alone. It is well to instruct these patients that when retrogression sets in they should return for further treatment.

Tinnitus aurium is not a very common symptom in purulent inflammation, but it is an occasional sequel of that trouble. The treatment just detailed for the deafness is the best adapted for the subjective noises also.

CHOLESTEATOMA.

In this disease there is an excessive growth of epidermis in the external auditory canal and desquamation of epithelial cells in the middle ear. Lumps of epidermis and shiny, pearl-like, little masses are found, both during and after suppuration. Bezold believes them to be the result of an extension of epidermic formation from the external canal to the middle ear. Lucæ reports a case without any suppurative process. Virchow believes they are true heteroplastic tumors.

The epidermis of the external meatus spreads over the walls of the middle ear, and even invades the mastoid antrum, but the latter is the result of excessive proliferation of epidermis accompanied with exfoliation. The concretions are of a caseous appearance, containing, besides epithelial cells, fat-globules, bacteria, and crystals of cholesterin.

The mastoid process is more often the seat of these masses than the tympanic cavity. They increase to a large size as the bone is destroyed either by advancing caries or necrosis or as the result of absorption due to pressure.

"J. Habermann concludes that a long-continued discharge of pus into the external auditory canal and retention of this secretion in this passageway lead to a chronic inflammation in the epidermis and excessive formation and exfoliation of the horny layers. Another reason for the development of cholesteatoma in the ear is the chronic inflammations of the bone of the external auditory canal and in the middle ear, conditions which induce a copious supply of blood in the ear and a consequently better nutrition of the Malpighian layer, and increase in the number of its cells." ("American Year-book," 1902.)

The diagnosis is not difficult if the excessive formation and desquamation of epidermis are noticeable in the external meatus, and if the epidermic masses are visible in the middle ear through a perforation. Chunks of foul-smelling, gritty, cheesy particles may be found in the washings from the ear. The perforations are most likely to be found in Shrapnell's membrane, for the growth of epidermis inward is marked on the upper wall of the canal. Long-continued and obstinate suppuration is characteristic of this disease. The masses constitute a dam against the free exit of the discharges, and decomposition of pus and the growth of polypi are encouraged. This condition forms a fruitful soil for the propagation of bacteria.

When the cholesteatoma is situated in the tympanic attic or in the mastoid antrum the diagnosis is difficult, if not impossible, to determine, unless the masses disintegrate and are evacuated during the cleansing treatment, or unless the mastoid cortex breaks down and exposes the condition present. If the diagnosis can once be positively made out, the question of operative measures is settled. The methods of treatment are found under the headings of "Chronic Suppuration" and "Mastoid Operations." Bezold advises epidermic transplantations in cholesteatomatous cavities, after the Thiersch method.

FACIAL-NERVE PARESIS AND PARALYSIS.

Impairment or loss of function of the facial nerve is due to a variety of causes. The facial canal and neurilemma may participate in a middle-ear inflammation; ulceration and necrosis of the bone may involve the nerve; an exudate, a callus, a sequestrum, or a tumor may produce pressure; syphilitic or other central nervous disease may exist at the origin of the nerve, or traumatic injury may partly or wholly paralyze it. The lower branches supplying the nose, side of the face, and angle of the mouth are generally more affected in paresis from the mastoid operation than the upper branches that are distributed to the orbicularis palpebrarum. But in some cases the forehead and face are for a time seriously affected, even when the eye can be closed completely, but slowly, and with an effort.

The same side of the velum palati may be involved in the paralysis. If the muscles of the side of the face and angle of the mouth are paralyzed, the patient cannot drink liquids without their driveling from the lips, nor inflate the cheeks without the air escaping from the paralyzed corner of the mouth; in laughing the face is drawn to the unaffected side, giving a crooked appearance to the countenance (Fig. 186). The facial expression is entirely lost on the side that is paralyzed. The inability to close the eye exposes it to winds, sunlight, and dust, resulting in chronic conjunctivitis.

Recovery may be expected from paresis due to an acute inflammation of the Fallopian canal and the sheath of the facial nerve secondary to the middle-ear inflammation, and from slight injuries to the nerve during mastoid operations (Fig. 187). Paralysis, or complete loss of conduction of the nerve, resulting from caries or necrosis of the facial canal, or from division of the nerve during an operation, presents an unfavorable prognosis. In this condition the eye cannot be closed.

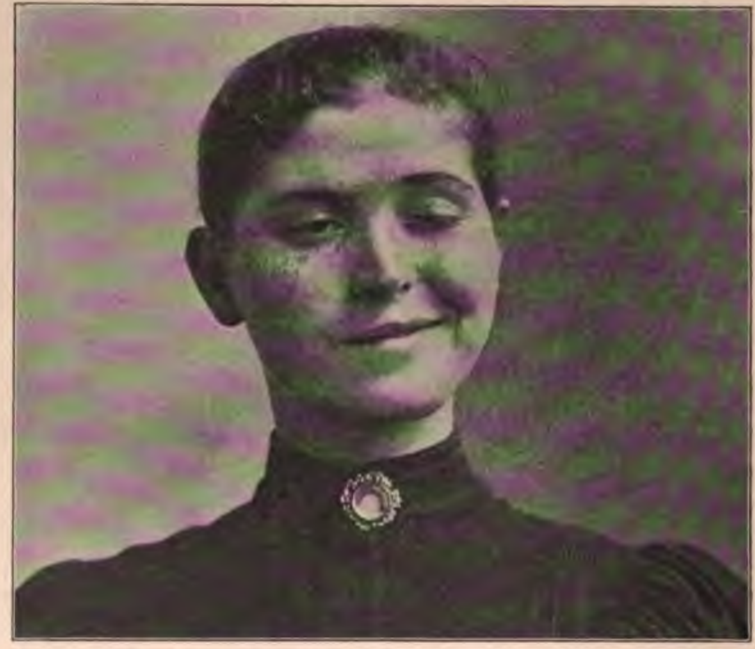


Fig. 186.—Facial Paresis. Appearance the same as in permanent facial paralysis. The patient is photographed while laughing.

Dench says: "Injury to the facial nerve is not a serious accident, function being restored in from three to five weeks, in most cases, under the use of the faradic current." The author is not in accord with this view. If the whole calibre of the nerve-trunk is not affected, but only certain bundles, spontaneous resolution may occur and complete restoration of function in three to six months; but the author has never seen a case of complete recovery take place after total paralysis of all its branches had occurred from injury to the nerve during an operation. He has seen varying degrees of interrupted transmission in the different branches of the nerve, with corresponding variations in the recovery. The eye being the least and the side of the face and mouth next least affected would recover completely, while the occipito-frontalis muscle remained powerless, giving a noticeable drooping effect to the eyebrow.

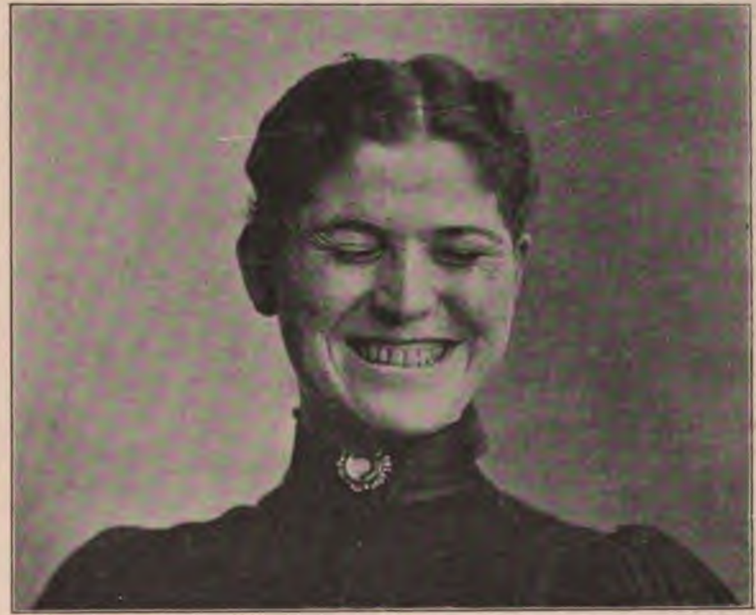


Fig. 187.—Same as Fig. 186, Three Months after Stacke Operation and Treatment with Electricity.

On the other hand, we have had cases of paresis, affecting all the branches, occurring after operations for excision of the ossicles through the meatus, etc., recover completely after the use of the galvano-faradic current for three or four months. But we must make the distinction between paresis, or partial paralysis, and actual paralysis, which is a complete loss of nerve integrity.

In the course of the nerve which is most exposed to traumatism during the mastoid operation the bundles distributed to the orbicularis oris, the muscles of the side of the face, the occipito-frontalis, and the corrugator supercilii seem to lie externally to the fibres composing that part of the anterior temporal branches that supply the orbicularis palpebrarum, for the latter muscle is the least affected in operative paresis and the first to regain its function.

Treatment of facial paresis and paralysis depends upon the lesion present. If the latter is an acute inflammation with exudation, upon the subsidence of the inflammation and the absorption of the exudate recovery takes place. If there be pressure of the pus on an exposed nerve in middle-ear suppuration, or if a sequestrum of bone produce the pressure, it must be removed. If syphilis is the cause, iodides and mercurials must be employed on general principles. Sexton mentions facial paralysis due to dental irritation.

These cases recover after a course of the iodides, pilocarpine, and electricity, the current being used from the primary coil of a faradic battery. The negative pole is applied to the ear of the affected side by means of an ear-electrode (Fig. 188), and the positive to the opposite ear or mastoid region, then to the groups of affected muscles, causing perceptible, though not painful, contractions in them. Such a treatment should be given three or four times a week, continuing ten minutes. This prevents muscular atony or atrophy, while the nerve regains its tone.

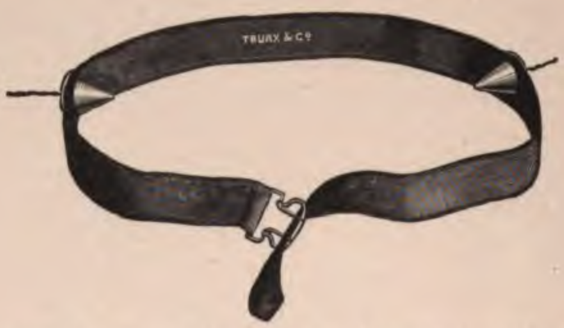


Fig. 188.—The Author's Ear-electrodes, Attached to a Head-band.

After the mastoid operation the electric current can be applied directly to the injured section of the facial nerve by saturating a pledget of absorbent cotton with sterilized water or hydrogen dioxide, placing it in the bottom of the wound, and connecting the ear-electrode directly with this. The other pole is then applied to the trunks of the several branches of the nerve distributed to the groups of muscles affected. If one is not familiar with these points he can readily determine them by applying the facial electrode to the opposite side, observing what areas need to be touched in order to contract the desired muscles. In Fig. 223 No. 1 shows the point where the electrode will affect the infra-orbital, malar, and temporal branches of the facial nerve. These supply the muscles of the forehead, the orbicularis palpebrarum, and the muscles of the face, nose, and upper lip. No. 2 shows the point where the electric current will reach the buccal and supramaxillary branches distributed to the buccinator and orbicularis oris and muscles of the lower lip and chin.

CARIOUS PROCESSES IN THE TEMPORAL BONE.

These do not characterize a large percentage of the cases of middle-ear suppuration. They are sometimes due to tuberculous and other constitutional taints. While very small areas are likely to be affected, they may extend to involve the whole temporal bone. Scarlatina is one of the most frequent causes, but syphilis and typhoid fever may also give rise to them. The pneumatic portion forming the mastoid process is the most often affected. Next in frequency come the tympanic walls and adjacent tissues. The anvil and sometimes the head of the mallet are attacked by the necrotic process.

Pain is a pretty constant symptom of caries except in tuberculous individuals, the amount of pain being determined by the extent of periostitis or interference with the free discharge of pus. Other distressing symptoms in addition to pain characterize this condition: dizziness, noises, nausea or vomiting, insomnia, and fever. The discharge is disgusting, often bloody and irritating. Granulations and polypi are commonly found, and the ossicles may be dislocated so as to wash out when the ear is syringed, together with sequestra of dead bone (Fig. 189). The meatus may be involved,—swollen or ulcerated. If the disease attack the inner tympanic wall, the external wall of the Fallopian canal may be destroyed, exposing the facial nerve to pressure or to the inflammatory process, resulting in facial paresis or paralysis of the same side.

Exfoliation of the cochlea takes place in rare instances. Richey reports two such cases. Goldstein, in a very interesting communication on the subject, reported a case of exfoliation of the cochlea, the vestibule, and the semicircular canals. A fair degree of hearing for conversation with the affected ear remained. Later Ruedo, of Madrid, reported a similar case with retention of hearing.

Toeplitz has reported a case of primary labyrinthal necrosis with facial paralysis and deafness from scarlet fever. During the suppurative process two sections of the cochlea were exfoliated and removed through the external auditory canal.

The diagnosis of necrosis or caries is not an easy affair unless it can be seen or felt. The probe may detect it if within reach, but the diseased bone may be defended by a growth of granulations forming a more or less complete carpet. Great caution is required in probing so as not to displace the little bones or open up the labyrinth to the introduction of pus. If the treatment detailed under the caption "Chronic Suppuration of the Middle Ear" does not succeed, after persistent effort, in diminishing and finally stopping the foul discharge, it is safe to infer that there is a carious condition of the bone. Caries is especially dangerous when the roof of the middle ear is its seat, for it may terminate in a rupture which will admit the pus into

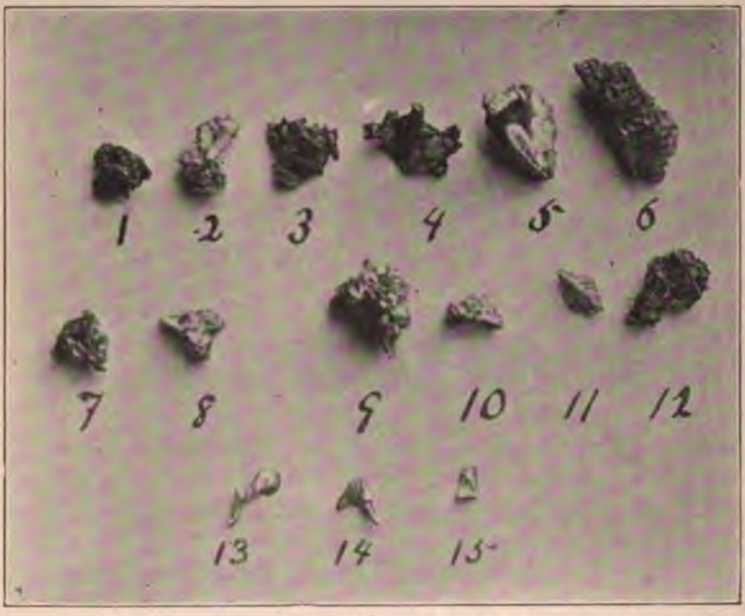


Fig. 189.—Sequestra of Dead Bone, and the Ossicles. Actual Size. (Author's Specimens.) The smooth surfaces of the walls of the tympanic cavity and of the meatus are shown in Nos. 1, 2, 3, 4, 5, 6, and 11. 13, Mallet. 14, Anvil. 15, Stirrup.

the cranial cavity. When the pyramid is invaded the hearing is destroyed and an unfavorable prognosis must be given.

Erosion of the carotid canal may occur, or of the lateral sinus, with fatal hæmorrhage. Such a case of destruction of the carotid canal came under my observation by the kindness of J. R. Davey which necessitated a ligation of the common carotid artery. Repeated copious hæmorrhages occurred from time to time, that could only be stopped by packing the meatus. Complete recovery followed ligation of the common carotid artery.

Another method of termination is an extension of the caries to the cranial cavity and lateral sinus, or it may excite suppurative meningitis or phlebitis, or end in brain-abscess. A perforation of the inner table of the mastoid process may allow the pus to filter into the current of blood in the lateral sinus, producing pyæmia. The writer has such a typical specimen in his collection (Fig. 190).

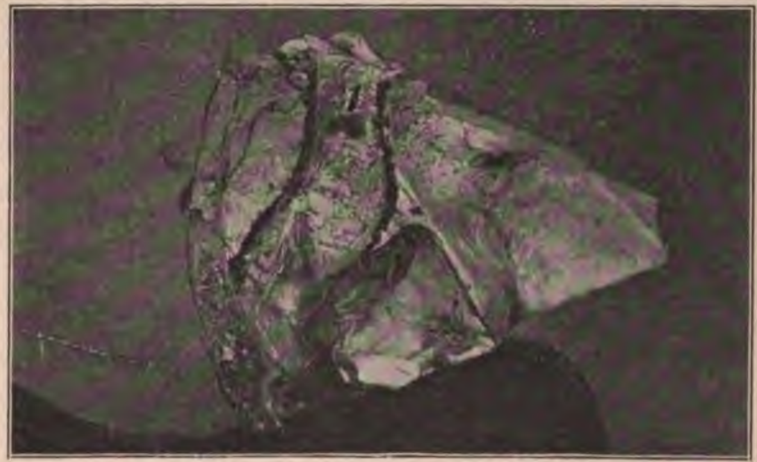


Fig. 190.—Post-mortem Section of the Temporal Bone, showing a Perforation of the Lateral (Sigmoid) Sinus at 1. (Author's Specimen.) Borders of sinus bounded by black lines.

This was the case of a man with mastoiditis for whom I advised an immediate operation. The physician in attendance deferred the operation until, when it was performed, the patient was suffering profoundly from pyæmia. A hopeless prognosis was given. Autopsy revealed the perforation of the lateral sinus shown in the foregoing figure, through which the purulent contents of the mastoid cells were flowing. Fig. 225 is the same mastoid process as Fig. 190, showing where the fistula (No. 2) opened beneath the tip of the process and the attachment of the sterno-cleido-mastoid muscle, resulting in an abscess of the neck, located underneath this muscle. No. 3 shows the opening made by a small trephine directly into the antrum, in which the probe rests. No. 4 is a tuft of cotton in the external auditory canal. There is no doubt that this patient's life could have been saved had the operation been submitted to when it was first advised.

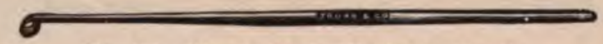


Fig. 191.—The Author's Middle-ear Curette.

Treatment includes thorough cleansing and disinfecting of the suppurating cavities and removal of granulations or polypi, as detailed in the foregoing pages. Anodynes must be given for severe pain. The denuded, roughened bone, if within reach, should be scraped free of all carious tissue with the middle-ear curette (Fig. 191), but only the most delicate resort to such procedure should be had in case the caries is located on the inner tympanic wall, for it is thin and easily perforated when carious (Figs. 192 and 212). After

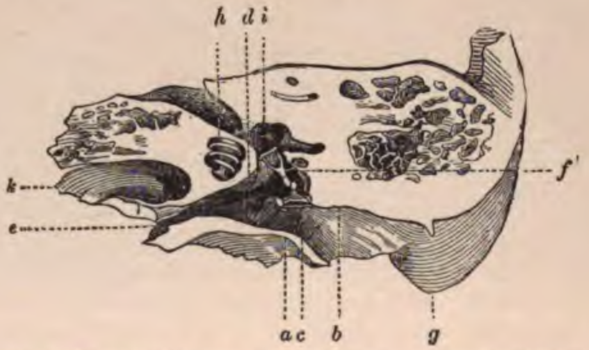


Fig. 192.—Horizontal Section of the Ear. (After Politzer.) *a*, Anterior wall of the osseous meatus. *b*, Its posterior wall. *c*, Section of the membrana tympani, of the handle of the malleus, and of the posterior pouch. *d*, Promontory. *e*, Ostium tymp. tubæ. *f*, Stapes in connection with the inferior extremity of the long process of the incus and of the tendon of the stapedius. *g*, Mastoid process. *h*, Cochlea. *i*, Vestibule. *k*, Carotid canal.

curetting, the treatment as detailed for chronic suppuration is called for.

Sequestra are removed with ease or difficulty according to their size, shape, and location. Patients sometimes present pieces of dead bone that have become exfoliated and appear in the syringing process. The author has removed quite a large sequestrum from a boy 4 years old by means of cotton on a holder. During the examination the cotton used for drying out the ear was observed to become engaged in the angular spiculæ of a sequestrum. So it was twisted firmly into them and drawn upon, with the result of extracting the quite large sequestrum completely (Fig. 189, No. 2, actual size). Other sequestra (actual size) from various cases are shown in the same figure. When the sequestra are too large and irregular to be extracted through the meatus without inflicting unwarrantable injury, they may be crushed by sequestrum forceps and removed in fragments. When an extensive sequestrum cannot be removed through the natural channel and suppuration cannot be cured, and especially if urgent or dangerous symptoms supervene, it is advisable to open the mastoid process and remove as much of the posterior wall of the meatus as is required to extract all the dead bone. The diseased surface should then be curetted, dressed, and treated as detailed under "Mastoid Operations."

The general condition of the patient may call for tonics and alteratives, which will readily occur to the practitioner.

CHAPTER XL.

EXTENSION OF EAR DISEASES TO THE CRANIAL CAVITY.

INTRACRANIAL complications of suppuration of the middle ear take place in the following ways: By an extension of the carious process in the temporal bone to the cranial cavity, with evacuation of pus into the latter; by extension through the vessels and fenestræ that penetrate the bone, resulting in purulent meningitis; by the formation of an extradural or brain-abscess, and by septic involvement of the venous sinuses, resulting in phlebitis, thrombosis, embolism, and septicæmia.

MENINGITIS COMPLICATING OTITIS.

Symptomatology.—Severe and continuous headache, localized or general, increasing in intensity and accompanied with photophobia, generally characterizes the onset of this disease. There are nausea or vomiting, sleeplessness, loss of memory, general hyperæsthesia, dullness of intellect, and in children delirium and convulsions of the face (same side) and extremities. In the advanced stage opisthotonos may occur. The pupils are firmly contracted at first, afterward dilated and not responsive to bright light, but they are sometimes unequal. The temperature, like many of the other symptoms, is not constant, but it varies from 101° to 105° F. The pulse is accelerated at first, becoming slower by cerebral compression, and later again increasing. The respiration is irregular and jerky in inspiration, followed by a pause, and of a lengthened, sighing character in expiration. Hemiplegia or paralysis of one or more extremities may occur, and when the third, fourth, or sixth nerve is involved strabismus follows. At last the power over the bladder and bowels is lost, the respiration is accelerated, the pulse rapid and compressible, and finally general paralysis is followed by coma and death.

Diagnosis.—This is, many times, difficult to determine, especially in children. The elimination of any other affection in the course of a purulent inflammation of the middle ear, the occurrence of constant fever, headache, and vomiting constitute the most important diagnostic points. Add to these the signs of injection of the retinal vessels and optic neuritis, and the diagnosis is rendered quite certain.

Prognosis.—Without operation, death.

Treatment.—If cold is agreeable the icecap should be continuously applied, bromidia given for pain, and the bowels relaxed. If a specific infection is suspected, iodide of potassium is indicated. The great fatality warrants an early surgical operation, which is described below and in Chapter XLII.

EXTRADURAL ABSCESS.

This is a localized accumulation of pus hemmed in by adhesions of the meninges to the internal table of the skull. It generally results from a slow extension of the disease of the tympanic cavity through the thin partition of the bone separating the latter from the cranial cavity.

Symptomatology.—There are generally some fever, intense pain over the temporal bone, and the symptoms of meningitis; exacerbations are followed by improvement after a sudden discharge occurs from the ear. The abscess may not be located in any part of the motor tract; so that no localizing symptoms appear. Frank S. Milbury details an instance of suppuration of the middle ear and mastoid process eventuating in a subdural abscess with consequent pressure on the left temporo-sphenoid lobe of the brain. There were facial paralysis of the left side, slight paralysis of the right arm and leg, impaired mentality, and amnesic aphasia. (*The Laryngoscope*, December, 1897.) The temperature rarely rises above 102° F. Tenderness over the painful area is usually present. When the cerebellar fossa is invaded, giddiness and vomiting may be expected.

Diagnosis. — This is obscured, as appears from what has been said, by the indefiniteness of the symptoms. The points in diagnosis are detailed above.

Prognosis.—This is unfavorable when the abscess ruptures internally, but when it breaks externally or is evacuated by an operation recovery may take place.

Treatment.—Operative treatment only is effective. It consists of laying bare the tympanic cavity by the Stacke method (see "Mastoid Operations"), evacuating the pus-cavity, removing all granulations and dead bone, cleansing, disinfecting, and dressing with aristol or iodoform and sterilized gauze. If no pus is found and the cerebral pulsation is absent, as often happens in brain-abscess, the aspirator-needle may be used to explore the site of a suspected pus collection.

CEREBRAL AND CEREBELLAR ABSCESSES.

These are the result of a chronic, rather than acute, suppuration of the middle ear. Over one-fourth of all cerebral abscesses follow this disease. Twice as many men as women are subject to brain-abscesses. They are generally located either in the temporal lobe or in the same side of the cerebellum as the aural disease (Bergmann). They may be deep-seated or superficial, single or multiple, in one or both sides of the cerebrum. Caries in the roof of the tympanum usually causes cerebral abscess, which covers the posterior surface of the pyramid, but caries in the mastoid process causes cerebellar abscess. The size of the pus-cavity resulting varies from an eighth of an inch (three millimetres) to several inches (centimetres) in diameter.

Symptomatology.—Bergmann classifies the symptoms of such abscesses as follow: 1. Those of suppuration: paroxysmal fever, chills, dullness, mental depression, loss of appetite, indigestion, rise of temperature in region of abscess, and tenderness on percussion. 2. Pressure symptoms: headache, dizziness, unconsciousness, delirium, twitching and paresis in extremities and facial muscles, strabismus, disturbance of vision and speech, slow pulse, sleepiness, Cheyne-Stokes respiration, eclamptic attacks, and intermissions. 3. Pus in the temporal lobe, with inability to speak certain words, is a rare condition. When located in the cerebellum it produces dizziness and a staggering gait.

The time-limits of brain-abscess are very variable. It may exist indefinitely without urgent symptoms. An old abscess contained within a connective-tissue capsule may remain innocuous until it ruptures outwardly, producing meningitis, or until encephalitis supervenes in its vicinity, or it may discharge into the ventricle. A fatal issue may result from metastatic abscesses. For example, the writer has seen the whole anterior aspect of the thigh converted into an immense pus-reservoir. There is a marked predilection for the lungs. The end may be preceded by cerebral compression, great prostration, or paralysis of the respiratory or circulatory centres.

Diagnosis.—This is sometimes impossible, for the symptoms are absent until the end approaches. When the health steadily declines without other assignable cause, coupled with otorrhœa, insomnia, constant temperature of about 99° F., localized pain in the same side of the head or in the occiput, we are safe, by the process of exclusion, in arriving at a diagnosis of this disease.

Prognosis. — Without operative interference the termination is fatal, but the prognosis has been illuminated with the brilliant records of Macewen and Körner, 95 per cent. recovering from operations by the former and 60 per cent. of the cases compiled by the latter.

Treatment.—Until a diagnosis can be made, there remains little to do except to direct our efforts toward improving the general health and relieving temporary symptoms. A surgical operation is the only curative measure.

OPERATIONS FOR BRAIN-ABSCESSES.

Referring to the skull (Figs. 209 and 210) that the author has prepared to illustrate the various operations for trephining and for mastoid diseases, the surgical relations of the parts involved will appear. The field of operation is prepared on the previous day by shaving, scrubbing with soap and water, and afterward with alcohol or ether, leaving a generous margin hairless (Fig. 224). Then the head is bandaged with sublimated gauze. The bowels are relaxed by a saline draught on the previous evening and evacuated by an enema on the morning of the operation. Nothing but beef-tea is allowed on the operating day. While ether is generally to be preferred in other operations, chloroform is allowable in this instance, since it causes a depression of the cerebral centres, while ether acts as an excitant.

The point selected for the centre of the half-inch trephine is seven-eighths of an inch above the centre of the meatus (Fig. 209). Incisions at right angles to each other are usually made, intersecting each other at this point, although Horsley prefers a semicircular flap. The cut should penetrate to the bone, and all the soft tissues are raised (Fig. 204), preserving the periosteum, and retracted by the double hooks (Fig. 205). The trephine now having been used, if the opening is not capacious enough it can be enlarged without injuring the dura by an ingenious device of De Vilbiss, of Toledo, or with the chisel. The dura is opened in a valve-shaped flap by a circular incision one-eighth of an inch inside the bone-perforation, so as to permit of this remaining margin being sewed to the flap of the dura afterward if necessary. If there is no cerebral pulsation the abscess may be expected to be superficial, but even if pulsation is present there may be a deeply seated pus-cavity.

The aspirating-needle should now be inserted in the supposed direction of the abscess if no pus appear. Or a sharp bistoury may be cautiously introduced once or twice or even a third time in different places. If pus escape the opening is enlarged, as complete evacuation as possible is effected, and the cavity is cleansed, disinfected, and packed with iodoform gauze, or a rubber drainage-tube may be inserted. If no pus is found the dura is sutured; the bone button, having been preserved in sterilized warm water, is replaced; the periosteum is stitched *in situ*, the soft parts are brought together, and the skin-wound is closed with the finest catgut suture. Sterilized gauze, absorbent cotton, and a bandage constitute the dressing employed.

When the abscess is located over the roof of the mastoid antrum, the latter is opened, and in most of these cases it is filled with either pus or a cholesteatoma. Enough of the roof of the antrum is chiseled away to allow of examination of the dura. If the latter is covered with granulations or if no pulsation is present, it should be entered. If no pus is found, a way is made leading to the roof of the middle ear (Küster), avoiding the facial nerve and semicircular canals by going above the former and external to the latter. An incision is then made in the middle portion of the temporal lobe. The after-treatment is described above. Knapp performs the tympano-mastoid cranial operation for otitic brain-abscess.

F. L. Jack reports a case of brain-abscess over the tegmen tympani, with aphasia, resulting from middle-ear suppuration. Recovery took place after an operation with chisel and rongeur forceps through the squamous portion of the temporal bone, exposing a large surface of the middle cranial fossa.

Cerebellar abscesses may be reached by chiseling the mastoid process so as to penetrate the posterior fossa without opening the lateral sinus, or the trephine may be used so as to perforate the occiput between the occipital and the lateral sinuses (Fig. 209, *v*). It should not be forgotten to always give a very guarded prognosis. Besides the causes of fatal termination already mentioned the end may be hastened by hæmorrhage from the middle meningeal artery, gangrene of the brain, pyæmia, and prolapsus of the brain. Zaufal first opens the posterior fossa, and if results are negative then the middle fossa, if the cranial cavity is to be opened after a mastoid operation.

SINUS-PHLEBITIS AND SINUS-THROMBOSIS.

These complications result from caries or necrosis of the posterior tympanic wall in a considerable proportion of cases, but the lateral (sigmoid) sinus is the vessel most often affected. The superior perosal and cavernous sinuses and the internal jugular vein are rarely involved; the latter is in caries of the inferior tympanic wall. While the cause is generally an extension of the necrotic process of the bone to the walls of the sinus, phlebitis may also result from septic infection transmitted by the veins communicating with the sinus. We may have accompanying this condition cerebral abscess or meningitis. The preceding suppuration has generally, but not always, been of long duration. The attack is sudden and characterized by pain in the occipital region and neck, chills, loss of appetite, and a temperature above 104° F., with remissions. The pulse is rapid, the skin dry, the tongue dry and coated, but consciousness may or may not be affected. Occasional symptoms are dizziness, stiffness of the muscles of the neck, optic neuritis, vomiting, delirium, convulsions, coma, and others suggestive of septicæmia. When the internal jugular vein is affected, a dense cord, tender on pressure, may be distinguished along the anterior border of the sterno-mastoid muscle if the neck has not become too œdematous. If the cavernous sinus is involved the œdema may extend to the face, nose, and eyelids. The fatal termination, which often occurs in about three weeks, is most likely to result from pyæmic pneumonia. However, the duration varies greatly from a few days to months. Recovery cannot be expected without surgical interference.

Treatment. — Stimulants, nourishing diet, and antipyretics are indicated until the operation is decided upon. The mastoid process should be opened (see "Mastoid Operations") and the sigmoid sinus laid bare. If it has not the natural dark-blue color or pulsation, but is hard, thickened, and inflamed, a thrombus is probably present. If a broken-down thrombus or pus is present, there will be fluctuation and absence of pulsation. The aspirating-needle should be inserted to ascertain the nature of the contents. If either condition mentioned is found, the sinus should be laid open longitudinally with a sharp bistoury, cleaned out with forceps and curette, washed with bichloride solution, 1 to 2000, and dressed with iodoform gauze.

If the internal jugular vein is thrombosed, it should be ligated low enough in the neck to get below the thrombus. The upper segment is brought out of the wound, the thrombus removed, and the vein is treated as already indicated. This will prevent infection of the lungs if resorted to early enough.

CHAPTER XLI.

DISEASES OF THE MASTOID PROCESS.

Pathology.—Primary acute inflammation of the mastoid process is a rare disease. Any affection of this part is nearly always consequent upon a middle-ear inflammation. The disease may be limited either to the lining membrane of the pneumatic spaces or to the periosteum of the cortex, or both membranes and the bone itself may be involved. In the acute form the latter condition is most likely to prevail, especially when it is consecutive to an acute middle-ear suppuration. Unless the inflammatory process is speedily interrupted, necrosis of the bone may occur, with a growth of unhealthy granulations; the formation of a fistula, either externally through the cortex, presenting a post-aural abscess, or through the posterior wall of the bony meatus (Fig. 210), or internally, communicating with the cranial cavity through the lateral-sinus wall (Fig. 190) or through the roof of the tympanic cavity. In this manner the posterior or the middle fossa (Fig. 193) may be invaded by the purulent discharge, thus giving rise to meningitis, subdural abscess, sinus-thrombosis, pyæmia, or brain-abscess. M. D. Lederman reported a case of extension of middle-ear and mastoid suppuration to the cranial cavity, in which "softening of the lower portion of the right temporo-sphenoid lobe of the brain was found, accounting for paralysis of the arm and leg of the opposite side" (*The Laryngoscope*, July, 1896). Moos (*Archives of Otology*, July, 1894) reported a case of "mastoid disease extending outward by way of the mastoid fissure, the continuation of the petrosquamous suture."

In the more favorable cases the discharge contained within the antrum and cells may find exit through the middle ear and external canal, or, if pus form beneath the mastoid periosteum, the resulting post-aural abscess may rupture spontaneously. This often occurs when the pus has found its way from the antrum through a fistulous opening in the cortex; so that the mastoid antrum comes into direct communication with the external world. In 1884 the author treated such a case in a lady nearly 80 years old. The discharge had ceased and there was a fistulous opening, surrounded by the blackened, exposed bone three-eighths of an inch (one centimetre) in diameter, leading into the tympanic cavity. The hearing for conversation was not lost, no inconvenience was suffered, and she did not wish the opening to be closed. The patient remained in excellent health when last seen, twelve years afterward.

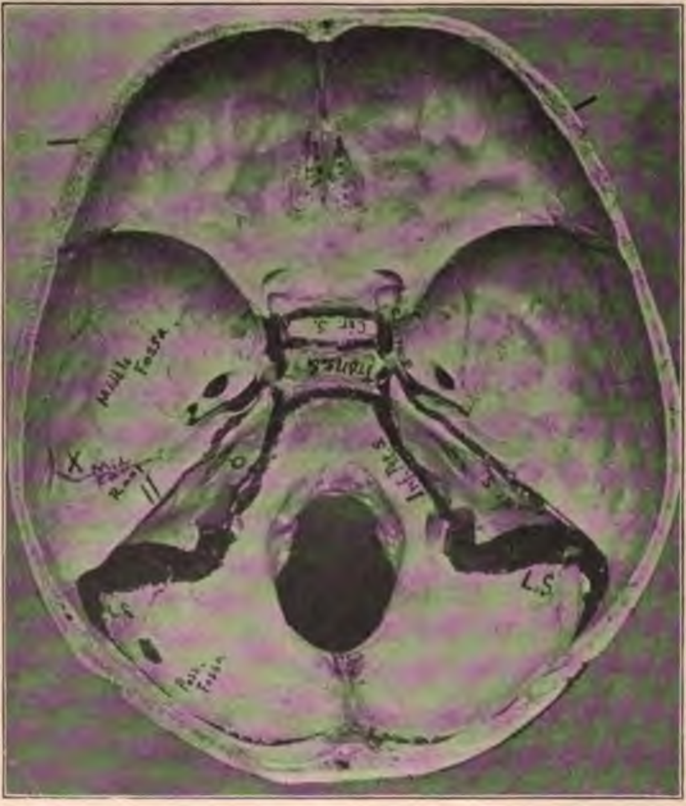


Fig. 193.—Interior of Base of Skull. (Author's Preparation.) *LS*, Lateral (sigmoid) sinus. *ll*, Parallel lines over the superior semicircular canal. *O*, internal auditory meatus. *X*, Opening by trephine for abscess over the middle ear. The cranial fossæ and sinuses are shown. The lateral sinus of the right side extends farther forward than the left.

An occasional result of inflammation of the mastoid cells is a proliferation of osseous tissue, which fills and obliterates the pneumatic spaces, leaving the whole area a dense, ivory-like mass. I have encountered a few such processes in which no pneumatic cells could be found, and the chisels were bent and chipped as though driven against stone (osteosclerosis).

Etiology.—Primary mastoiditis may occur as the result of traumatism or exposure to cold. Generally mastoid disease is a complication and is most prevalent during influenza epidemics. In the latter case, at least, it is probable that a bacterial infection occurs through the Eustachian tube from the respiratory passages, since it has been demonstrated that the diplococcus of pneumonia is present in the mastoid discharge (Scheibe). Frank Rumbold reported a case of mastoiditis in April, 1898, in which he attributed the attack, in a patient suffering from diabetes, to carious teeth of the lower jaw. After a mastoid operation had been performed without marked relief the diseased teeth were extracted, after which the patient experienced freedom from pain and made a good recovery.

It should be borne in mind that the relations of the antrum and middle ear, being connected by the aditus ad antrum, or passage from the tympanic attic to the antrum, are such that any fluid in the tympanic cavity naturally gravitates into the mastoid antrum when the patient reclines upon his back. Indeed, the antrum is the drip-cup of the tympanum, and whenever there is considerable fluid in the middle ear it finds its way into the antrum. This does not of necessity imply an inflammation of the pneumatic cells, but when micro-organisms—streptococci, etc.—are present the danger to the integrity of the lining membrane and delicate cellular structures is apparent.

Symptomatology.—Acute mastoiditis is accompanied with pain, which, though only slight and annoying at first, becomes violent and exhausting as the disease progresses. After a few days the tongue becomes coated and the temperature elevated two or three degrees. If there is periostitis there are also tenderness, redness, and swelling over the mastoid region. Pain is sometimes referred to the temporal, the supra-orbital, or the occipital region. Fluctuation denotes either a subperiosteal abscess or a fistula. Great variations in temperature during the day should excite suspicion of sinus-thrombosis; but as descriptions of intracranial complications have already been given (Chapter XL) they will not be repeated here. A most noticeable sign of mastoid periostitis and œdema of the overlying structures is a pronounced prominence of the auricle, which projects out conspicuously at a right angle to the side of the head.

Pain is not always present in mastoid disease, especially after the acute stage has passed, and one must not expect to find the whole group of symptoms present in every case. They are not constant. Great destruction may take place in the process without proportionate discernible manifestations. This demonstrates the insidious and dangerous character of the disease. If there is no ear discharge in acute mastoiditis of the cells, one may expect to find a bulging drumhead, and the postero-superior wall of the meatus may be found depressed.

The inflammatory process may continue for several weeks with recurrences and remissions of the symptoms, but the closest watch must be kept in order that any impending invasion of the cranial cavity may be averted by prompt surgical interference. Pus may invade the middle fossa through the tympanic roof or antrum. If it break posteriorly from the middle ear or mastoid cells, it reaches either the lateral sinus or the posterior fossa. If it advance anteriorly from the middle ear, it may form a superficial abscess in the neck or a retropharyngeal abscess. It may break through the inferior surface of the mastoid process and form an abscess beneath the sterno-mastoid muscle (Fig. 225). If it find an outlet through the inferior surface of the petrous portion of the temporal bone, it may burrow beneath the deeper layer of muscles even to the thoracic cavity. When the cervical tissues become infiltrated in the region of the sterno-mastoid muscle, or an abscess of the neck forms, the head becomes more or less fixed, the face everted, and movements involving this muscle are restricted and painful. When a retropharyngeal abscess is present the jaw is fixed and cannot be moved or depressed sufficiently to examine the tongue or throat except with great pain (Plates III and IV).

Diagnosis.—In acute mastoiditis the symptoms enumerated are so prominent and characteristic that no difficulty presents itself in recognizing the condition, but in chronic suppuration of the mastoid cells, in the absence of a fistula, it is not so simple a task. Persistent discharge, notwithstanding the treatment, foul odor, bulging of the postero-superior wall of the canal, tenderness over this region, and impaired nutrition indicate a mastoid disease.

Prognosis. — Uncomplicated acute mastoiditis, subject to early treatment, presents a favorable outlook. A large proportion of such cases will recover without an operation; but the treatment must be instituted promptly in order to prevent extensive destruction of the bone, and intracranial complication. When the latter occurs the prognosis is unfavorable without an operation; but surgical interference presents good chances of recovery if not delayed until the occurrence of septicæmia, brain-abscess, sinus-thrombosis and phlebitis, or meningitis. Vulpius (*Archives of Otology*, April, 1895) reports three cases of influenzal otitis, mastoiditis, and epidural suppuration cured by operations.

Treatment. — If the patient is seen before perforation of the drumhead occurs, and signs of fluid in the middle ear are discovered, paracentesis should be performed at once, as described in treating of acute inflammation of the middle ear (page 402). The incision should be a long one, for its tendency is to close soon. A case to the point occurred while writing this. It became necessary to make an extensive opening in the drumhead and to incise the bulging posterior wall of the meatus, under ether, although a few days earlier a minute perforation was enlarged under cocaine. The first incision had healed, the discharge ceased, and great pain and a sense of pressure ensued from the accumulated pus that was unable to escape.

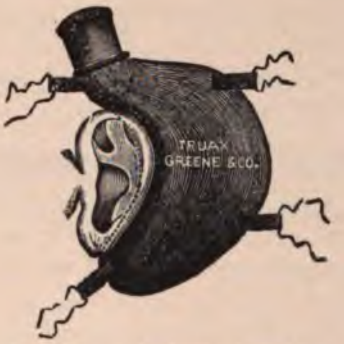


Fig. 194.—The Author's Icebag.

In acute inflammation the icebag (Fig. 194) should be applied without delay, and kept continuously in place until either the inflammation subsides or it becomes evident that an operation is imperative. The crushed ice must be replenished as fast as it melts. One or two days may be long enough, but I have found it necessary at times to maintain constant cold for three or four consecutive days and nights. Sometimes an exacerbation occurs and the ice must be resorted to again. This plan succeeds in some very serious cases, but if pus has formed the ice may fail. For example: two children about

6 years old presented acute mastoiditis on the same day, and ice was applied alike to both. In five days one was discharged cured and the other developed a post-aural abscess, on opening which a fistula was found leading to the antrum. The icebag was powerless in the one case to avert a mastoid operation, because destruction of osseous tissue had already taken place.

Counter-irritation by mustard over the whole mastoid region, and along the course of the Eustachian tube when it is involved, often assists materially. It should be used nearly, but not quite, to the point of vesication, and then replaced by spirit of camphor on a flannel compress until the blush fades and the cutaneous irritation is again indicated.

Leeches afford speedy relief during the acute, intense stage of the inflammation. They should be applied over the mastoid process near the auricle. Detailed directions for applying leeches will be found in the treatment of acute inflammation of the middle ear (page 405). General antiphlogistic treatment and anodynes are frequently called for, with laxatives for the bowels, as mentioned under the same heading.

If the application of the icebag is followed in a few days by subsidence of pain, fever, and the other symptoms, or if the cold is badly borne, it should be discontinued. If, in spite of all these antiphlogistic measures, the steady march of the destructive process is not stayed, an operation must not be too long delayed. A week or ten days may give sufficient time for extensive infiltration and invasion of the more vital organs. Nevertheless, the writer has seen numerous instances in which very grave and alarming symptoms have yielded to this palliative method of treatment,—cases in which excellent surgeons believed an operation to be unavoidable.

But it is a matter of duty to emphasize the possibility of a sudden fatal termination if the necessary operation is too long postponed. Fatal results have followed such delays and refusals to allow operations, but I have never seen a fatal termination due to the operation itself. The disease is dangerous; the operation itself, in the hands of a competent operator, is not. If the mastoid process contain necrotic tissue, the operation affords immediate relief. It gives free exit to the pent-up discharges and removes a threatening cause of disaster.

"I have memoranda of 143 cases operated upon for mastoid disease. Of these, 127 uncomplicated by pyogenic brain disease recovered. A few have required a second and even a third operation. In a few the recovery has been slow and tedious; but in no case has death resulted, directly or indirectly, from the operation, and in no case, so far as I have been able to learn, has death resulted from a return of the disease." (A. R. Baker.)

Edwin W. Pyle has reported his experiences in 100 mastoid operations, in which he had a mortality of 4 per cent. He says: "Four cases were operated upon, perhaps, too early and ill advisedly, but beyond the possibility of a doubt 96 would have been vastly benefited by earlier operative procedure." (*Archives of Otology,* volume xxx, No. 3, 1901.)

Any well-informed surgeon, after sufficient practice on the cadaver, can perform the operation with safety and success if he follow closely the rules laid down; but, in order to have well at command all the surgical relations of the parts concerned, the operation ought to be previously studied and performed numerous times on the cadaver. To illustrate: out of 17 mastoid operations which the author has made in one month, 12 were upon cadavers and 5 only upon patients.

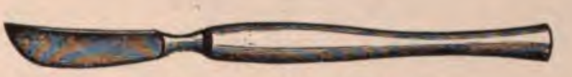


Fig. 195.—Buck's Mastoid Knife.

M. D. Lederman advises, as an abortive measure, incision through the posterior fold of the drumhead, extending through Shrapnell's membrane and into the superior wall of the meatus, so as to produce free blood-letting. (*The Laryngoscope,* January, 1898.)

Wilde's incision, at least, should be made as soon as it becomes evident, by the presence of a fluctuating swelling back of the ear, that pus is present. Anyone can do this with a sharp, strong bistoury (Fig. 195). The cut is made as nearly as possible in the line of the incision that may be required later for the mastoid operation, —about three-eighths of an inch (one centimetre), posterior to the insertion of the auricle and parallel with it (Fig. 216). The incision is carried down to the bone, the pus evacuated, and a fistula searched for with a strong probe. If none is present, and it is apparent that the abscess is subperiosteal, and no superficial caries of the bone needs curetting, the cavity is treated antiseptically, as will appear later, until pus formation ceases. Then it is allowed to close.

INDICATIONS AND PREPARATIONS FOR MASTOID OPERATIONS.

Indications for Operating.—The following six rules, by which the perplexing question of when to operate is decided, were presented by the writer in a paper before the first Pan-American Medical Congress, and received, with unanimity of opinion, the approval of the aural surgeons present, including Professor Politzer:—

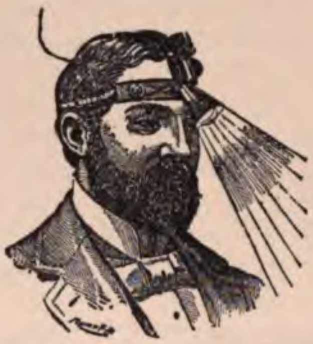


Fig. 196.—The Nevius Electric Head-lamp.

The mastoid process should be opened

1. When there is acute inflammation of the bone that resists palliative treatment.

2. When repeated swellings and abscesses occur.

3. When there is a bulging of the posterior and superior wall of the meatus, with suppuration of the middle ear.

4. When there is a fistula.

TRUAX, GREENE & CO.

Fig. 197.—A Strong Scalpel.

5. When there are severe pains in the same side of the head as the diseased ear and they resist all other treatment.

6. When a foul otorrhœa cannot be cured by any other means.

These rules may be termed conservative, and whatever deviation we may indulge in ought to be at once favorable to the operation and the welfare of the patient. Too great temporizing favors sinus-thrombosis, septicæmia, brain-abscess, and meningitis.

There are a few points in this connection worth mentioning, for they are closely related to a successful issue. Excellent illumination is had by the use of light reflected from a mirror on the operator's forehead, after the cortex is opened (Fig. 110). This affords a decided advantage over window-light. It is more intense, especially from the 60-candle-power incandescent gas-burner (Fig. 111); it can be thrown into the opening of the bone in every direction, and there are no shadows to obscure the field. The Nevius electric head-light (Fig. 196) affords an ideal illumination for mastoid operations. It is attached to the head-band by a ball-and-socket joint, and it gives a very brilliant light, exceeding a 16-candle-power lamp. It is operated by connecting it by a plug to an incandescent-electric-lamp fixture. We have used this illuminator in mastoid operations with the utmost satisfaction.

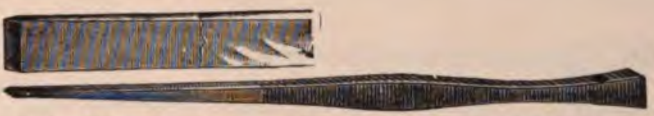


Fig. 198.—The Author's Mastoid Chisel. Actual Width.

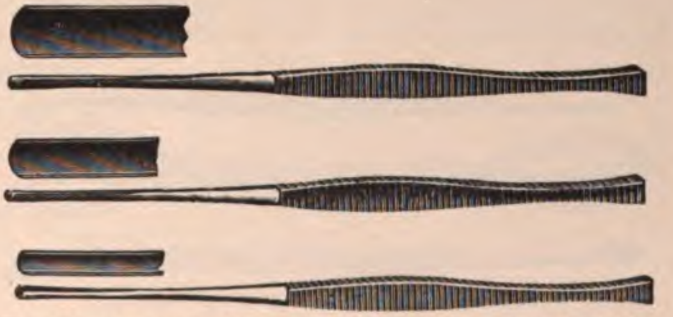


Fig. 199.—The Author's Long Mastoid Gouges. Actual Width.

Preparation of the Patient.—The day preceding the operation the patient's mastoid region, together with an area three inches in extent above and behind the auricle, is shaved and washed with soap and warm water, then with ether, and finally with very warm bichloride solution (hydrargyrum bichloride), 1 to 1000. The meatus is syringed with the latter solution. The parts are then dressed with sublimated gauze and a bandage. The bowels are relaxed the same evening, and beef-tea only is allowed on the day of the operation. Ether is preferable to chloroform on account of its greater safety. Only so much as is absolutely necessary to procure freedom from pain, movement, and shock is employed, in order to avoid a subsequent bronchitis or pneumonia.

The patient's clothing is removed from his shoulders and a blanket, covered with a rubber sheet, is substituted, so as to have the clothes clean when he is returned to bed. The hair, especially in the case of females, need not be entirely sacrificed (Fig. 224), as is often done, but it is preserved in a cleanly condition by enveloping it in a sublimated cap or towel or a rubber cap.

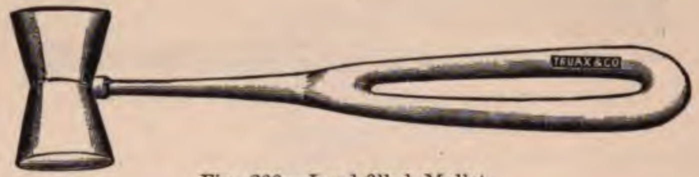


Fig. 200.—Lead-filled Mallet.

The operator and assistants prepare by rolling the sleeves above the elbows and vigorously scrubbing their forearms, hands, and nails with brush, and warm water and soap, and last with alcohol. Rubber aprons and operating-gowns complete the surgeon's toilet. A table forty-two inches high is preferred by the writer in order to escape the necessity of a wearying, stooping position during the operation. The patient's head rests on a small rubber drainage-cushion (Fig. 206).

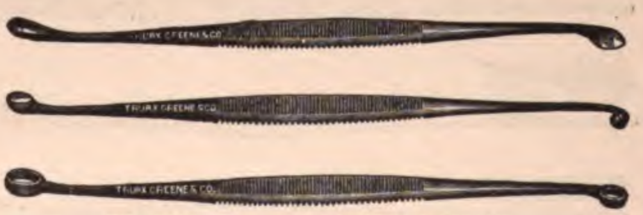


Fig. 201.—The Author's Set of Curettes.

The instruments, a quarter of an hour before they are needed, are boiled for five minutes in a 1-per-cent. solution of bicarbonate of sodium, which does not corrode, and then they are placed in warm, sterilized water. The scalpels are simply immersed in boiling water a moment. For many years the writer used a 5-per-cent. carbolic-acid solution for the instruments, instead of boiling, but a serious objection to this was that the operator's fingers were benumbed by the acid, for the instruments were kept immersed in the solution during the operation.

The instruments required are a couple of strong, sharp scalpels (Fig. 197), four artery-forceps, a periosteum elevator, self-retaining retractors, a strong chisel (Fig. 198), three sizes of long gouges (Fig. 199), a metal mallet (Fig. 200), several sizes of curettes (Fig. 201), strong probes and forceps, a mastoid guide (Fig. 202), tongue-forceps (Fig. 203), and a syringe (Fig. 143), with hot water.

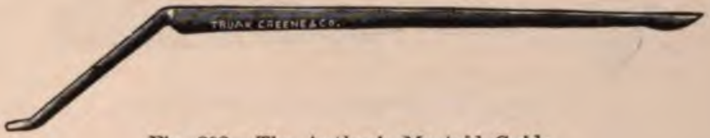


Fig. 202.—The Author's Mastoid Guide.

The periosteum elevator, retractor, and curette is a hoe-shaped device (Fig. 204) which overcomes a serious objection to the misnamed periosteotomes we have formerly used. Indeed, these instruments should not be "tomes" at all. They should not cut the membrane, but should lift it from the bone in continuity, so as to carefully preserve its integrity.

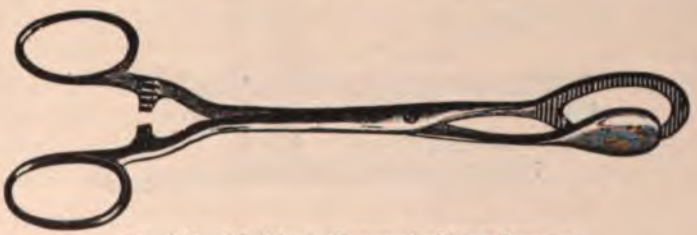


Fig. 203.—Mathieu's Tongue-holding Forceps.

The old periosteotomes put the operator at a disadvantage by necessitating an unnatural play of his muscles. With a pushing motion one has not perfect control of the movements of the instrument and it is likely to slip and cut where it is not desirable to wound. In the use of this kind of a lifter the motion is one of drawing or pulling toward one's self; so that the muscles brought into play are, together with the instrument, under easy control,—on the same principle as the farmer's use of his hoe, after which it is patterned.

As the separator serves the purpose not only of detaching the periosteum, but of retracting the loosened tissues, or of curetting necrosed bone, it may be said to constitute three instruments in one.

The self-retaining retractors (Fig. 205) take the place of an assistant in keeping the soft tissues out of the way of the operator and in controlling the hæmorrhage during mastoid and other operations of like magnitude. The retractors consist of two shafts, each armed with a series of hooks that can be brought together and interlocked for insertion into the incision, when they can be separated and fixed at any desirable point up to two inches apart. After they have been drawn apart as far as may be required, the thumb-screw on the fixation-bar next to the hooks should be screwed down firmly into the bar, the handles should be pressed a little together until the tissues are well stretched as the distal ends of the retractors separate, then the thumb-nut on the thread-bar should be turned down against the movable handle.

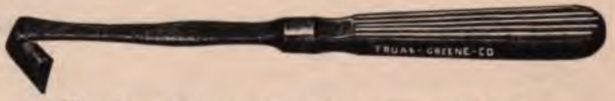


Fig. 204.—The Author's Periosteum Elevator.

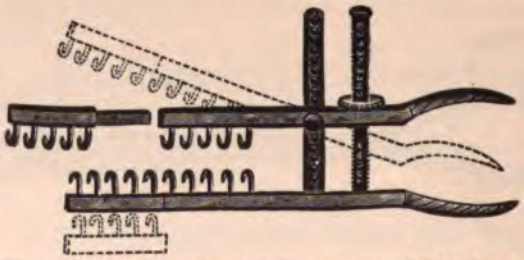


Fig. 205.—The Author's Self-retaining Retractors.

If the instrument is properly adjusted the tissues cannot slip out of its jaws, and their pressure on the stretched lips of the wound reduces the hæmorrhage to a minimum. In some operations these hooks have proved more effective than five artery-forceps.

The following arrangement renders these retractors equally useful in the smallest and the largest mastoid operations: The terminal half of the shaft of hooks can be slipped out of the main half, leaving the retractors only an inch long. Replacing the adjustable series of hooks makes them two inches long, and by drawing these adjustable hooks outward one-half inch one can lengthen the hooks to two and one-half inches. This has the effect, when the instrument is in position in a large wound, of making an opening two inches to three and one-half inches wide by three or more inches long, through which to work. However, the opening can be made as small as one wishes, and the capacity of the instrument is far beyond what we usually require in operations on the skull; but the writer has had it made so as to be of service in other and more extensive operations, since its size in no way impairs its efficiency in mastoid cases. The handles are constructed to take up as little room as possible.

When the adjustable parts of the hooks are removed for small operations the openings in the permanent hook-shafts, into which the adjustable hooks fit, may be securely sealed by a bit of beeswax to prevent the entrance of blood, etc. After being used, this wax will run out on the application of a little heat. A drop of oil should then be put in the same openings to prevent corrosion or sticking of the adjustable shanks.

The straight-edged chisel is employed to open the firm cortex, but after the antrum or cells are reached the writer's long gouges are better adapted to the work (Fig. 199). The length of the shafts allows the operator's hand to be sufficiently removed from the cavity to give an unobstructed field of vision.

As we cannot know the extent of the pathological process before entering the bone, it does not appear to be advisable to decide in advance upon any special method of procedure save one: remove all dead and diseased tissue. Whatever method does this is best. Stacke's and Bergmann's operations have the advantage of affording the greatest accessibility to the tympanum; so that if it is necessary to remove necrosed ossicles or diseased tympanic tissue it can be done with greater facility and thoroughness.

CHAPTER XLII.

THE MASTOID OPERATIONS.

For our purpose it is most convenient and practical to treat of mastoid operations under three headings: (1) the Schwartze mastoid operation; (2) the radical tympano-mastoid operation; (3) the modified operation.

The Schwartze operation is the one most commonly performed, and is adapted for primary mastoid abscess, or that condition in which it is necessary to penetrate the bone without entering the tympanic cavity.

The radical operation, devised by Stacke, is much more extensive and complicated, and is intended to open not only the antrum, but to expose the whole tympanic cavity and to remove one or more of the ossicles and any diseased tissue that may be found in the middle ear.

The modified operation is a convenient combination of the best principles governing the other two, more thorough than the first, and less menacing to important structures than the second.

The Schwartze Mastoid Operation.

All preparations having been made as already detailed (Figs. 206 and 207), the ear cleansed, etc., the auricle is bent forward and the incision is made, beginning at the apex of the mastoid and extending upward and forward until within three-eighths of an inch (one centimetre) of the auricular attachment; then it is carried parallel with the auricle to a level with its superior attachment. The incision should be made from below upward, for if made in a downward direction it is possible for the knife to slip off from the rounding surface of the mastoid tip and plunge into the soft tissues of the neck, for one naturally bears hard upon the knife to cut to the bone. The posterior auricular artery or its anterior branch will have been severed and is caught up with the small artery-forceps and twisted. The forceps can be left holding it, instead of stopping to ligate.

The bleeding may be considerable for a few minutes, and if a pus-cavity is opened the contents usually gush out with considerable force. The hæmorrhage is dried rapidly with small pieces of moist sterilized gauze, the assistant consuming as little time as possible. If necessary, several small artery-forceps can be used to arrest the venous flow, and they can be left *in situ* when the retractors are applied. The periosteal elevator (Fig. 204) is now used to separate the periosteum backward far enough to expose all the surface covering the cellular part of the bone, and forward to the posterior margin of the external meatus. The periosteum should be kept intact and carefully preserved. The self-retaining retractors (Fig. 205) are then inserted into the wound, the teeth being interlocked and resting

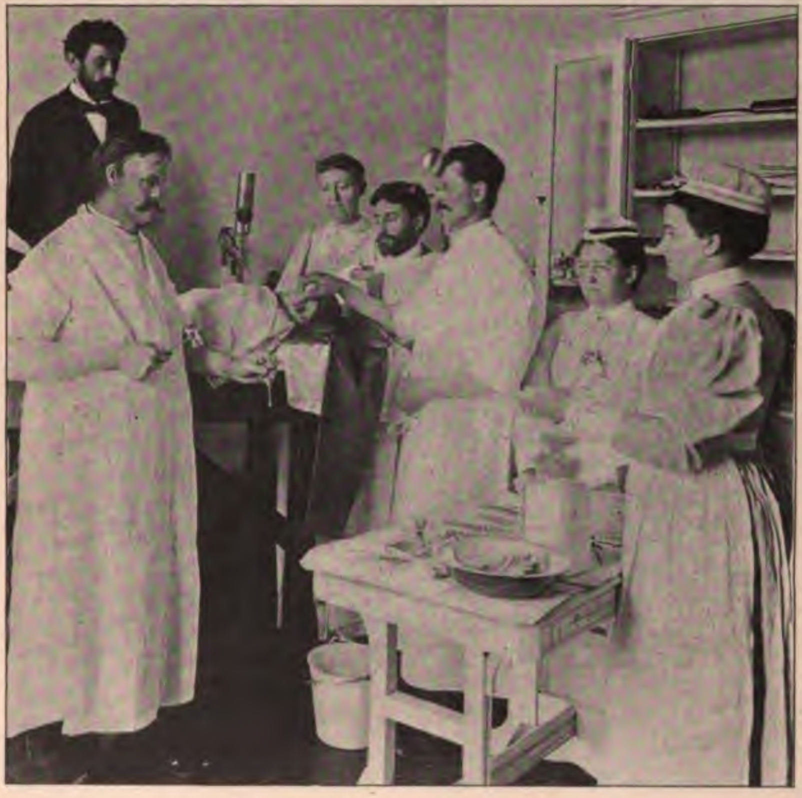


Fig. 206.—A Mastoid Operation.

on the denuded bone. They are then separated as far as possible and fastened as previously described. In short incisions, as in children, the additional hooks are not needed. The hæmorrhage now practically ceases from the soft tissues because of the pressure and stretching by the hooks. If a fistula in the bone is found, it is enlarged; if there is none, and the antrum is sought, the bone is opened on a level with the superior border of the external meatus and three-eighths of an inch (one centimetre) back of its posterior wall (Figs. 208, 209, and 210).

The mallet and straight-edged chisels are used to remove the cortex in preference to the trephine or drill. The broad chisel is best here. The strokes of the mallet must always be light enough to run no risk of forcing the chisel through softened bone into the vital parts. The cortex over the antrum varies greatly in thickness. In large pneumatic processes it may be as thin as an eggshell, and it can be easily penetrated with a strong probe, while one may drill a half-inch into a typical sclerotic process without finding a pneumatic cavity.

Fig. 207.—Operating-room and Accessories.

The general direction of the cone-shaped mass of bone to be removed is inward, forward, and a little upward (Fig. 208); but one must always bear in mind that these are relative terms, for we speak as if the patient were in an upright, instead of a supine position. A good rule is to keep close to the meatus, follow its direction, and keep above the horizontal plane of its axis if the antrum is to be opened (Fig. 211) and the facial nerve avoided.

As soon as the cortex is removed the forehead-mirror or electric lamp (Figs. 110 and 196) and brilliant illumination should be used (Fig. 111). If dead bone is reached there is little or no difficulty in distinguishing it from the healthy. It is softer, darker, crumbling, and is often filled with dark, fungus-like granulations as well as pus. It breaks down readily under the curette and should be entirely removed until nothing but healthy tissue is to be seen.

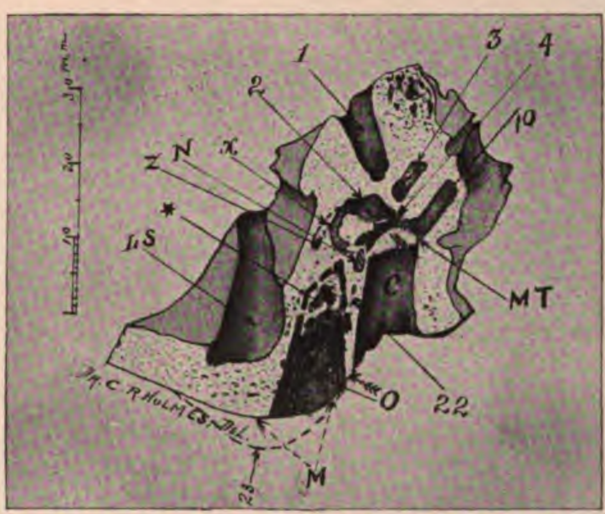


Fig. 208.—Horizontal Section through Right Temporal Bone, cut Two Millimetres above the Center of the External Canal. (After C. R. Holmes.) *O*, Opening in mastoid leading to antrum; the heavily dotted lines indicate the depth to which the opening penetrated in the upper section of this bone; small arrow indicates the relative position of the spina. 22, Wedge between opening in mastoid and external meatus. *M*. Mastoid. 23, Dotted lines indicating how osteosclerosis may increase the depth to which it is necessary to penetrate. *C*, external canal. *, Large cell in direct communication with the floor of the antrum above. *LS*, Lateral sinus. *z*, Posterior semicircular canal. *N*, Facial nerve. *x*, Horizontal semicircular canal. 2, Vestibule. 1, Internal canal. 3, Cochlea. 4, Fenestra ovalis. 10, Eustachian canal. *MT*, Membrana tympani.

The opening in the cortex should be made spacious enough to allow of easy inspection of all the interior of the process. In the adult the oval aperture should be about one-half by three-fourths of an inch in diameter or ten by twelve or fifteen millimetres, with the long axis in the vertical. The surgeon should be satisfied with nothing but thoroughness of detail. If the carious bone extend to the dura or lateral (sigmoid) sinus it is removed thus far, exercising great caution not to injure either, and, although it has often been necessary to expose both, we have never seen any ill results follow. If the sinus should be accidentally opened, the hæmorrhage will be profuse and will probably necessitate tamponing the cavity with iodoform gauze and postponing further operative procedure for a fortnight, unless sufficient pressure can be exerted to suppress the bleeding.

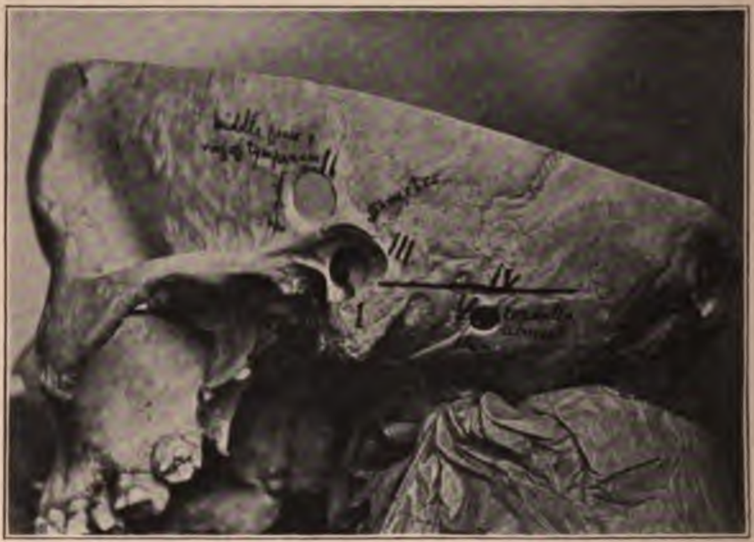


Fig. 209.—Side-view of a Skull, showing *(iii)* Opening in Mastoid Process for Schwartze Operation. (Author's Preparation.) The wavering black line just above *i* is the course of the facial nerve exposed; above and at the left of this is seen the tympanic cavity. *ii*, Opening by trephine to explore the roof of the middle ear. *iii* lie over the course of the lateral sinus. *iv*, Reed's base-line. *v*, Trephined opening for cerebellar abscess.

The variation in the distances between the external canal and the lateral (sigmoid) sinus is shown in the same individual on the opposite sides of a skull in my possession (Figs. 193, 212, and 213).

The surgical relations and close proximity of the sigmoid sinus, the facial nerve, and the semicircular canals are plainly visible in Figs. 208, 212, and 214 (*LS*, *N*, etc.).

In Fig. 193 the right lateral sinus extends farther forward than the left, as is the rule. "In an examination of 17 temporal bones Emil Amberg found that the thickness of the sinus wall varied from two and one-half millimetres to ten millimetres, the average being five and three-fourths millimetres." A. H. Andrews locates the lateral sinus by means of a tuning-fork, vibrating in contact with the skull behind the mastoid process, and a stethoscope placed over the process. The fork is moved forward toward the stethoscope, and "as soon as the border of the mastoid is reached a decided increase in the

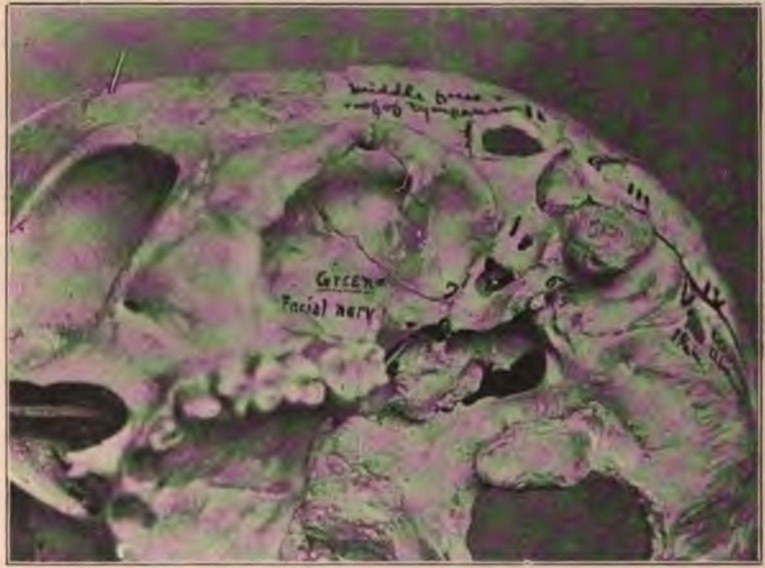


Fig. 210.—Schwartze Operation. (Author's Preparation.) View of skull from below, showing tympanic cavity, looking from below upward and inward. The antero-inferior wall of the osseous meatus is removed. *i*, Postero-superior wall of the meatus; at the right of *i* is an opening into the mastoid cells. *ii*, Opening above meatus for cerebral abscess. *iii*, Schwartze opening into antrum. *v*, Opening for cerebellar abscess. 6, Exit of facial nerve (black line running downward). 7, Stirrup in foramen ovale. The dark space just above the stirrup shows the opened Fallopian canal.

volume of sound from the fork is noted." ("Year-book of the Nose, Throat, and Ear," 1901.)

In many cases this operation suffices to effect a cure and it is not necessary to proceed farther. All projecting spiculæ of bone are

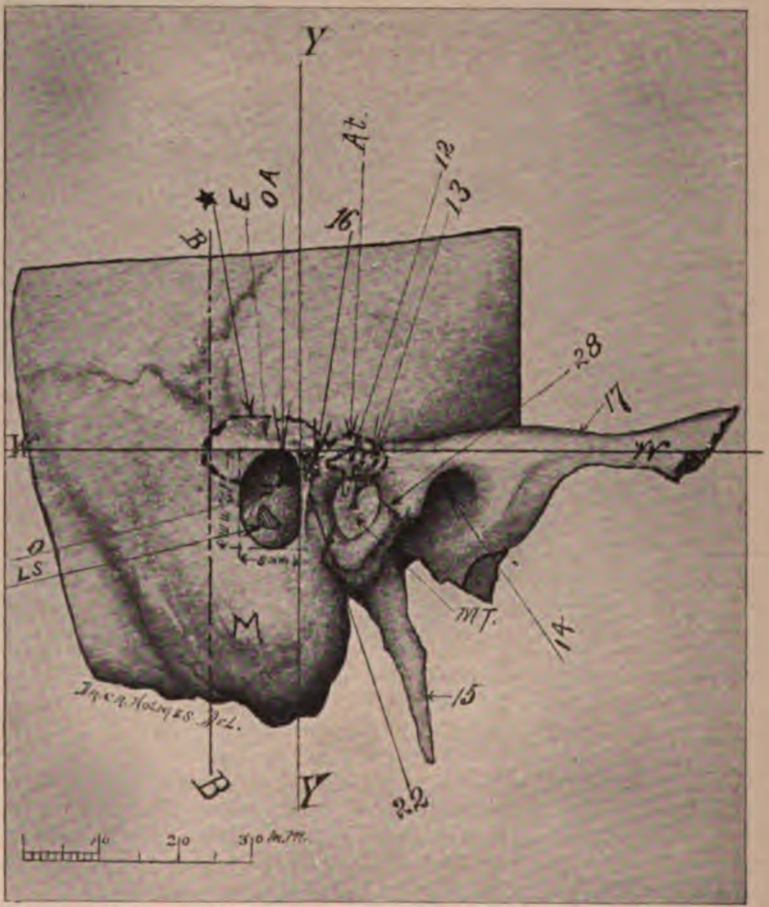


Fig. 211.—Opening of the Antrum. (After C. R. Holmes.) *W-W* and *Y-Y*, Horizontal and perpendicular planes of the skull. *O*, Opening in mastoid leading to antrum. *OA*, Antrum. *LS*, Lateral sinus. *M*, Mastoid process. 22, Posterior wall of external meatus. 15, Styloid process. *MT*, Membrana tympani. 14, Glenoid cavity. 28, Glaserian fissure. 17, Zygomatic process. 12 and 13, Outlines of hammer and anvil and location of attic. 16, Spina supra meatus. *, Dotted lines showing position of antrum. *E*, Linea temporalis.

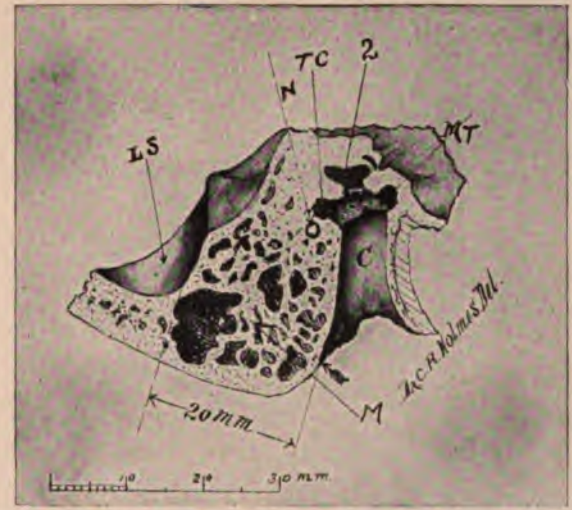


Fig. 212.—Horizontal Section through Right Temporal Bone, showing Distance between Lateral Sinus and External Canal. (After C. R. Holmes.) Cut begins below center of external canal, passing obliquely upward and inward. *LS*, Lateral sinus. *M*, Mastoid. *N*, Facial nerve. *TC*, Tympanic cavity. 2. Vestibule. *MT*, Membrana tympani. *C*, External canal. Small arrow indicates the point where a perpendicular line from the spina supra meatus would touch.

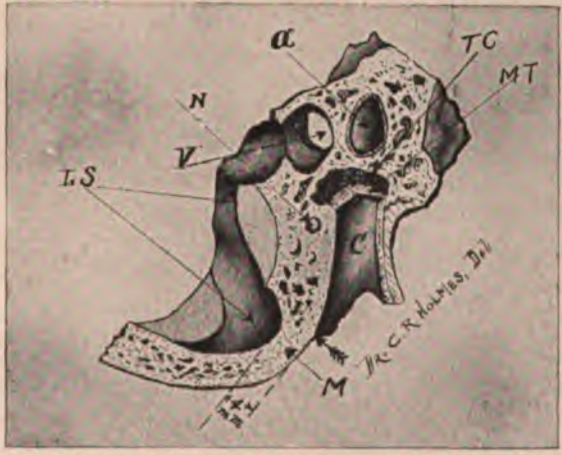


Fig. 213.—Horizontal Section through Right Temporal Bone, Cut Near Center of External Meatus, showing how Close the Lateral Sinus may come to the External Canal in Some Cases. (After C. R. Holmes.) *a*, Internal carotid artery. *V*, Internal jugular vein. For explanation of other letters see Fig. 208.

removed, rough corners rounded off, the wound is syringed with quite warm bichloride solution, 1 to 1000, then dried and sprinkled with aristol (Fig. 144) or iodoform powder (Fig. 178). The upper section of the wound is stitched to a level with the upper border of the bone-opening only. The cavity is packed very lightly with iodoform gauze, covered thickly with absorbent cotton, and the dressing is completed with a net or crinoline bandage. These bandages are not to be applied very firmly, since the sizing they contain, being moistened before they are applied, dries and contracts, setting somewhat like a plaster-of-Paris bandage. Later, a rubber adhesive plaster can be substituted for the bandage (Fig. 215). The wound is kept sufficiently open to permit inspection and treatment until the cavity fills with healthy cicatricial tissue.

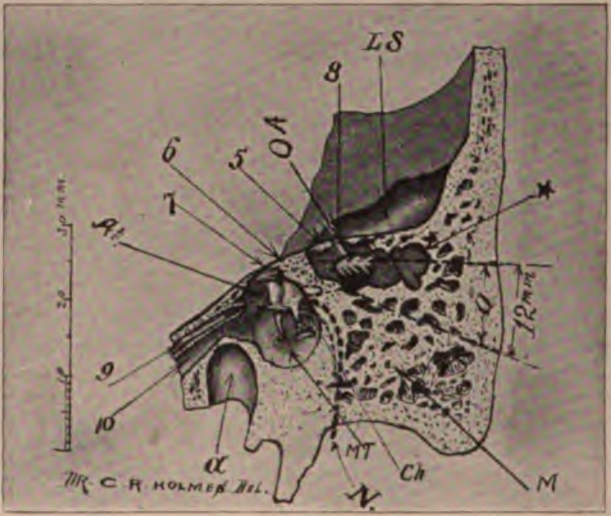


Fig. 214.—Perpendicular Section through the Right Temporal Bone, beginning at Line *B-B*, behind Opening *O* in Mastoid (Fig. 211), and Directed Inward and Forward, cutting Eustachian Tube in its Long Axis. (After C. R. Holmes.) *N*, Dotted lines show the course of the facial and chorda-tympani nerves. *M*, Mastoid. *Ch*, Chorda-tympani nerve. *MT*, Membrana tympani. *a*, Canal for internal carotid. 10, Eustachian tube. 9, Processus cochleariformis. *At*, Attic. 7, 8, Showing defects in the bone covering attic and antrum. *OA*, Opening into antrum (Fig. 211). *LS*, Lateral sinus. *, Antrum. *O*, Dotted lines indicating funnel-shaped opening (Fig. 211).

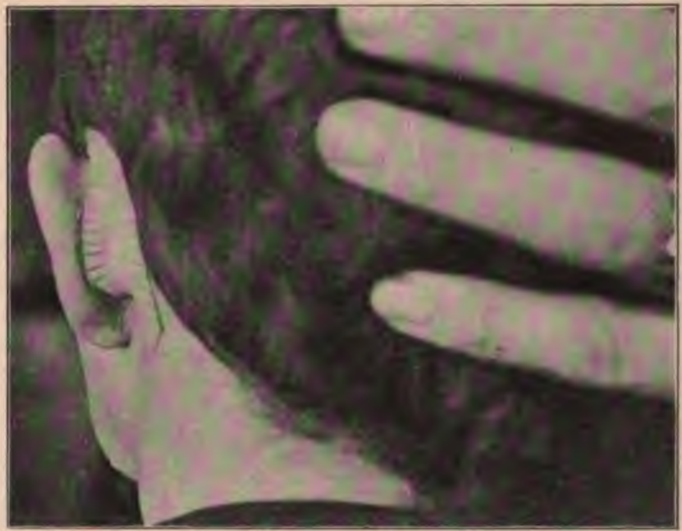


Fig 215.—Adhesive Plaster Dressing for Mastoid Wound. (Author's Case.)

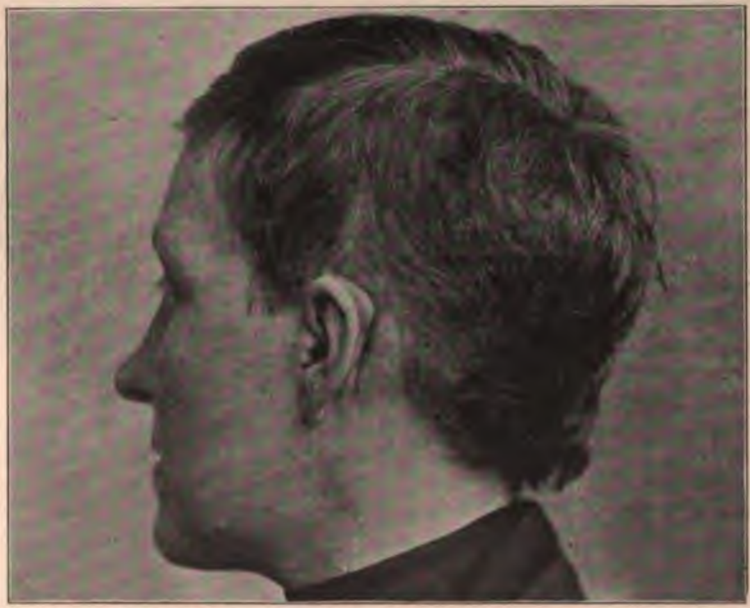


Fig. 216.—Line of Incision Healed Two Months after a Schwartze Operation. (Author's Case.)

The patient is now put to bed. In case the temperature was high before the operation it usually falls, but it may remain near 100° F. for a few days. The dressing is not disturbed for four or five days unless considerable hæmorrhage, discharge, odor, pain, or fever should call for it. Too frequent dressings and forcible irrigations retard new tissue formation, while too infrequent dressings favor decomposition, septic infection, and exuberant granulations. Even in this operation the author often connects the tympanum freely with the mastoid opening so as to permit a current of water to pass into one and out of the other for the sake of absolute cleanliness.

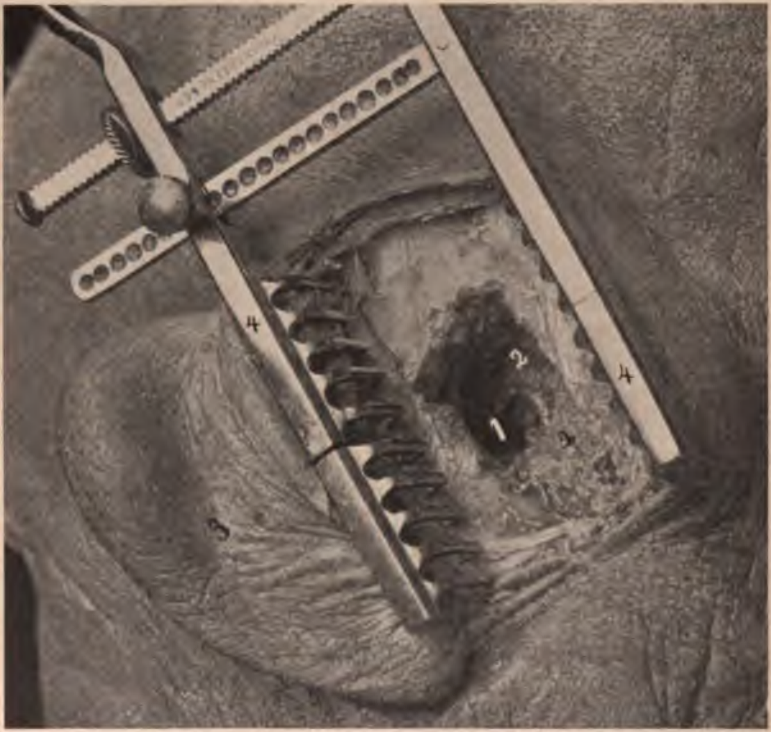


Fig. 217.—The Radical Tympano-mastoid (Stacke) Operation, Completed. Photographed Life Size. 1, Tympanic cavity. 2, Interior of mastoid process. 3, Auricle reflected forward. 4, Self-retaining double retractors.

The duration of this operation, from the first incision to the completion of the operation and insufflation of the powder, has varied

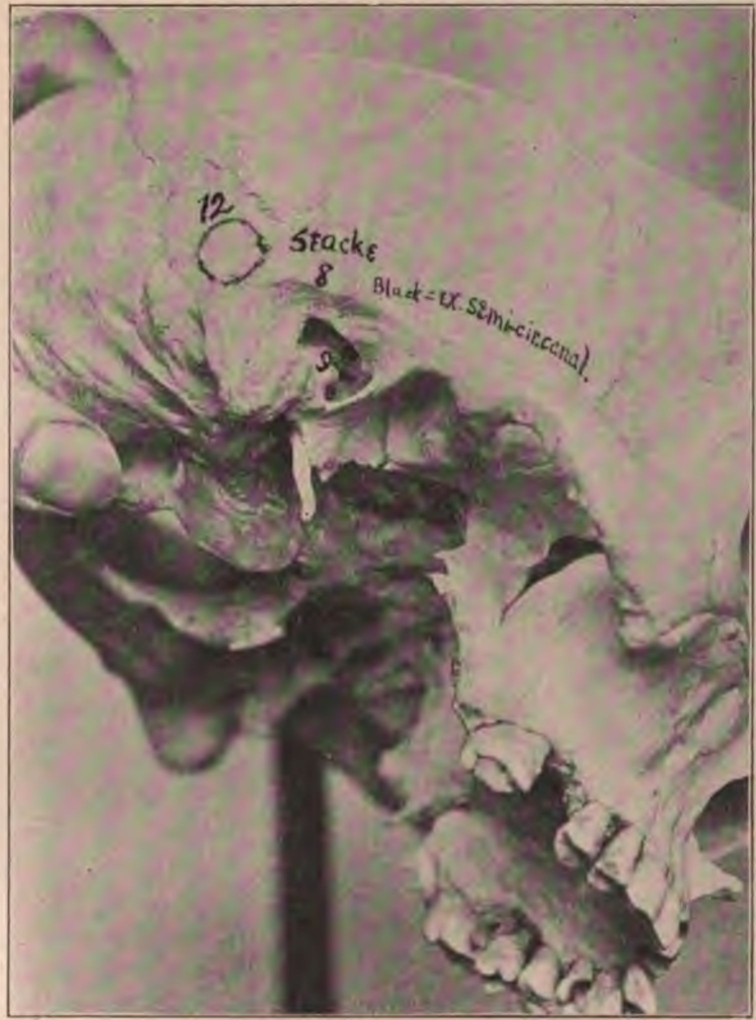


Fig. 218.—Side of Skull, showing Stacke Operation. (Author's Preparation.) The postero-superior wall of the meatus is removed. The antrum is seen below 8 and the oval window at the right of 9. Below the oval foramen is seen the round window, and the dark spot above and to the right of 9 is an opening into the external semicircular canal. The projecting ridge between this and the oval window is the Fallopian, or facial, canal. 12, Point for trephining to open the lateral sinus.

in my practice from fifteen to thirty-five minutes. With good assistants one can acquire dexterity in operating without incurring any risks, and the patients make a better recovery than when narcosis is protracted. The length of time required for complete recovery varies greatly. We have had patients leave the hospital in a few days or a week and have found them cured at the expiration of the fourth week, while others, for various reasons, extend over three or four months. Six or eight weeks would be a fair average time to give as necessary for a cure, and patients should be informed that it may require longer (Fig. 216).

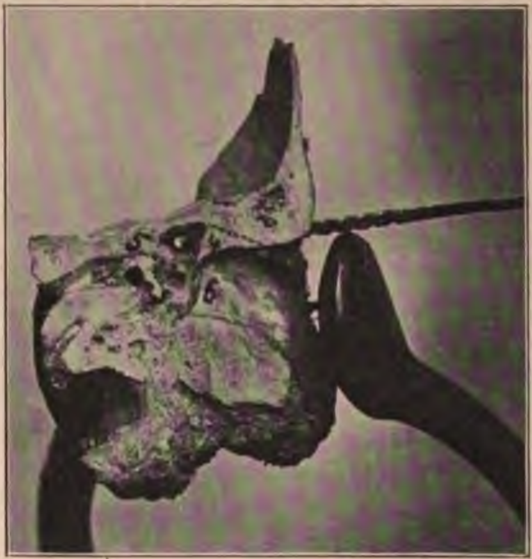


Fig. 219.—Vertical Section through the Ear. (Author's Preparation.) 4, Wedge-shaped portion of bone forming outer boundary of the tympanic attic; dotted line shows the section removed in the Stacke operation. 5, Dotted line shows course of facial nerve; the bright spot in the dark area between 4 and 5 is the end of the probe, seen through the aditus ad antrum, resting in the antrum. 6, Remnant of the drumhead.

The Radical Tympano-mastoid Operation (Stacke).

The first incision is the same as in the simple operation, except that it is carried above the insertion of the auricle and then forward as far as a point directly superior to the anterior wall of the meatus

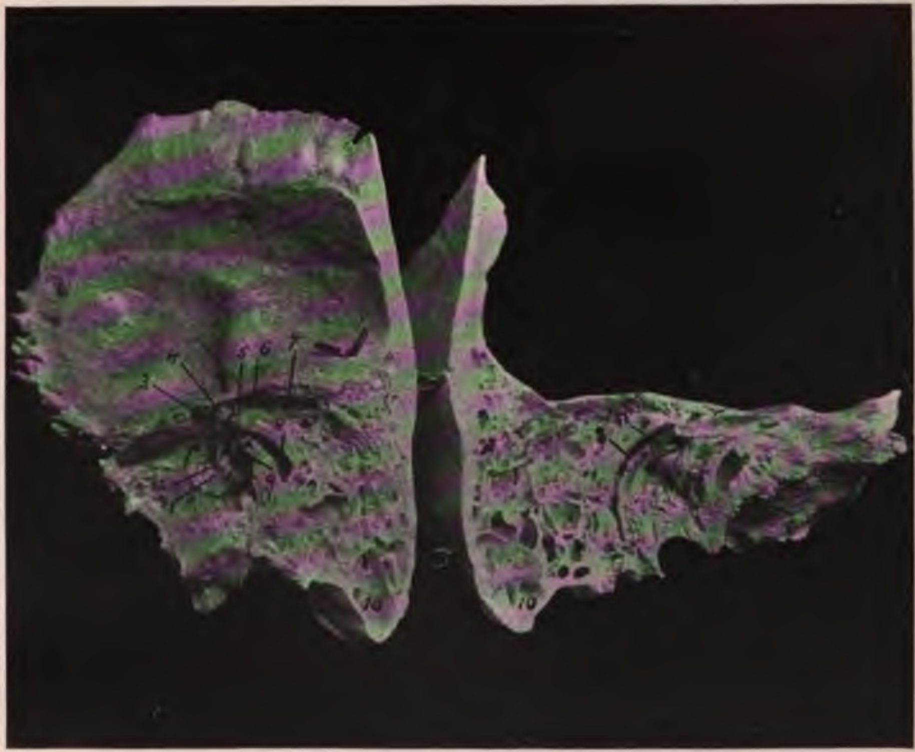


Fig. 220.—Section of the Temporal Bone (Actual Size) through the Mastoid Cells, Fallopian Canal, and Middle Ear, severing the Incudo-stapedial Articulation. 1, Membrana tympani. 2, Tip of the mallet-handle. 3, Chorda-tympani nerve, at the left of which is seen the canal for the tensor-tympani muscle. 4, Head of the mallet. 5, Articulating surface of anvil for the mallet. 6, Aditus ad antrum, connecting the tympanic attic with the mastoid antrum. 7, Usual location of the mastoid antrum; but in this anomalous specimen there are only capacious pneumatic spaces, instead of a large cavity. 8, Fallopian canal for the facial nerve. 9, Long crus of the anvil for articulation with the stirrup. 10, Large cavity, or antrum, in the tip of the mastoid process, another anomalous condition, with a thin shell of bone forming the cortex; between this antrum and 7, where the antrum should be normally, is a series of large cells connecting the two portions. 11, Articulating surface of the stirrup for the anvil.

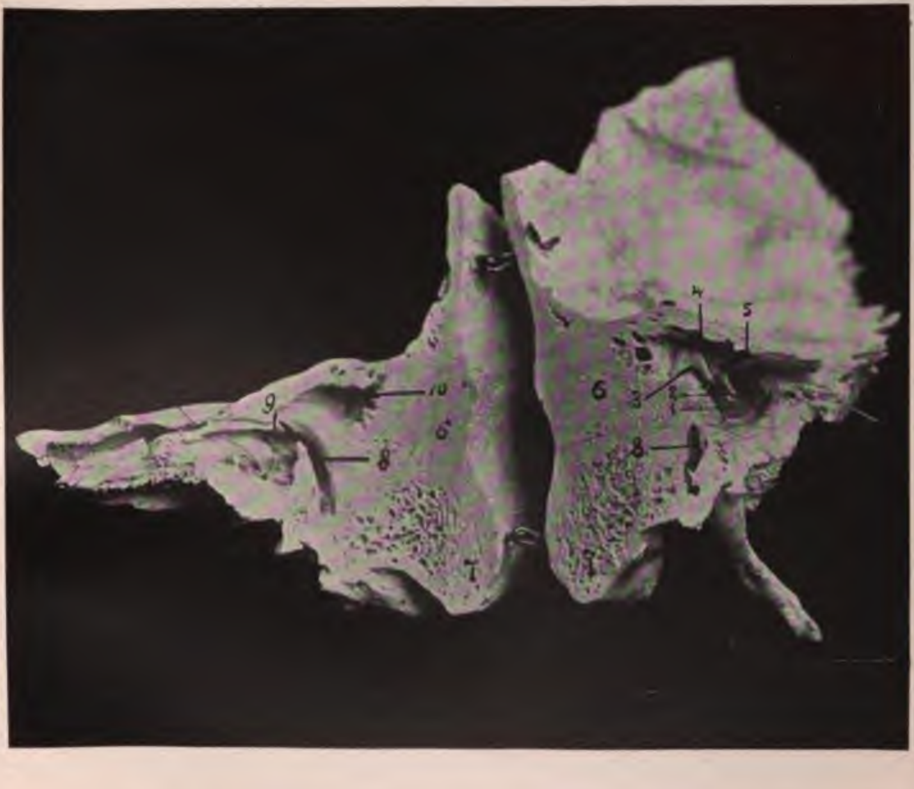


Fig. 221.—Section of the Temporal Bone (Natural Size) through the Middle Ear, Fallopian Canal, Mastoid Antrum, and Cells, showing Dense Bone between the Antrum and Cells, with no Communication between them. 1, Drumhead. 2, Tip of the mallet-handle. 3, Anvil, showing the long crus at the right for articulation with the stirrup, and the short process at the left which serves the purpose of an anchor to the bone. 4, Head of the mallet. 5, Tensor-tympani muscle and tendon. 6, Dense bone where pneumatic spaces are usually found. 7, Pneumatic cells in the tip of the mastoid process. 8, Fallopian canal, for the facial nerve. 9, The stirrup. At the right of 9 and at the left of the anvil is the aditus ad antrum, connecting the tympanum with the antrum.

(Fig. 217). After the periosteum is raised to the margin of the meatus the periosteal end of the mastoid guide (Fig. 202) is inserted between the posterior wall of the osseous canal and its periosteal lining, and the latter is raised as far as the membrana tympani. One can tell when the tympanum is reached, for at that instant resistance ceases. The instrument is carried no farther inward, but is moved carefully around the whole circumference of the canal, separating the membranous lining and preserving its integrity.

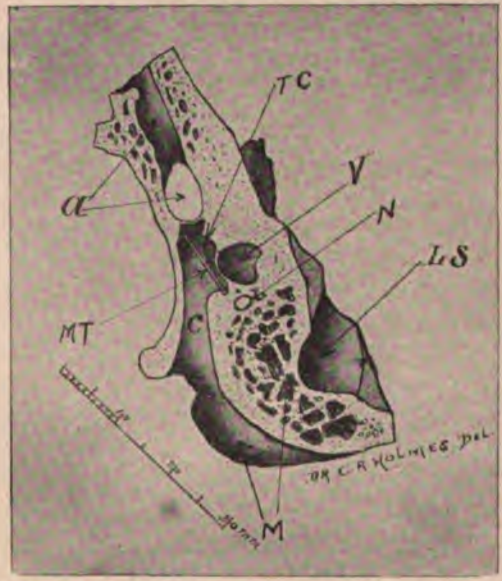


Fig. 222.—Horizontal Section of Temporal Bone, Cut Near Floor of External Meatus. (After C. R. Holmes.) *a*, Canal for internal carotid. *TC*, Tympanic cavity. *MT*, Membrana tympani. *V*, Bulbus of internal jugular vein. *N*, Facial nerve. *LS*, Lateral sinus. *M*, Mastoid.

The integument is now drawn out of the canal like a severed glove-finger and reflected forward with the auricle so as to expose the bony canal and drumhead. The latter is now detached. The posterior canal-wall is chiseled away, backward into the antrum and inward as far as the tympanic attic (Fig. 218), removing the wedge-shaped portion of bone constituting the outer boundary of the attic (Fig. 219, No. 4), until a bent probe, in contact with the attic-roof and drawn outward, meets no resistance. The whole inner wall of the tympanum is now exposed to view, and this cavity, the antrum, and the meatus are converted into one cavity. The surgical relations of these parts are clearly shown in Figs. 220 and 221. The anvil is detached from its articulation with the stirrup (Fig. 170) and removed with the pincette (Fig. 169), care being taken not to dislocate the stirrup and thus open the vestibule. The drumhead is removed in its entirety, together with the mallet. This is a simple manœuvre under the present conditions. All carious or necrotic tissue, granulations, or cholesteatomata are curetted away (Fig. 191).

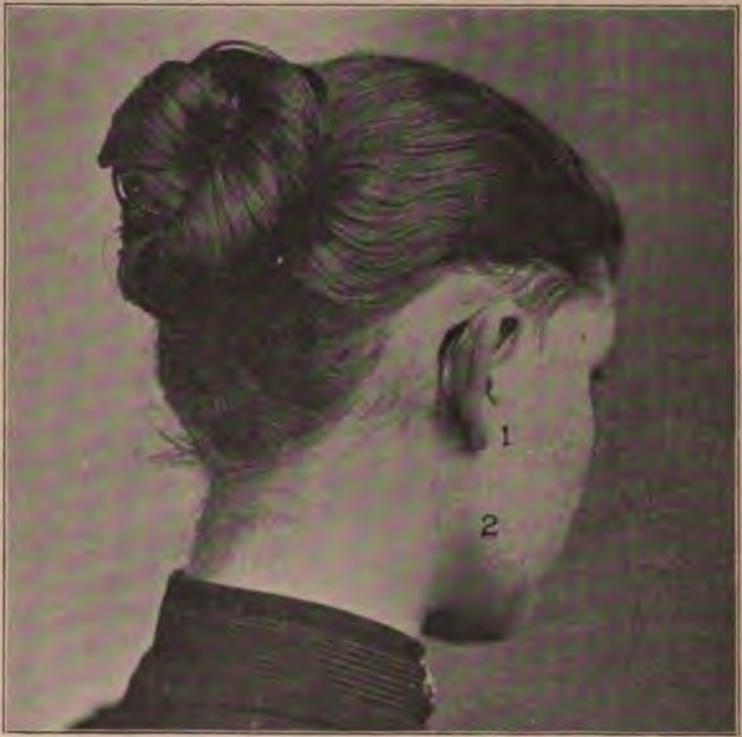


Fig. 223.—Six Weeks after Stacke Operation. (Author's Case.) *1*, Point to apply electric current to affect superior branches of the facial nerve. *2*, To affect inferior branches in treating facial paresis or paralysis.

When the membranous canal is returned to its place it is incised along the median line of the posterior wall, longitudinally, up to the concha, where an incision at right angles to the first is made through the posterior half of the circumference of the meatus. The two resulting flaps are packed—the one upward and backward and the lower downward and backward—into the mastoid cavity. This gives access to one large cavity for after-treatment through the meatus.

In this operation we have not only the lateral (sigmoid) sinus and dura to avoid, but the facial nerve and semicircular canals. To escape wounding the facial nerve, as soon as we arrive in its vicinity the mastoid guide (Fig. 202) is inserted into the attic, and the narrow toe of the foot-plate is passed through the aditus ad antrum and toward the antrum. The long handle is brought forward and downward over the cheek so that the end of the handle lies in a direct line with the lower border of the upper teeth or lip. Then the foot-plate falls over the Fallopian canal containing the nerve, and the chisel will strike the guide before it can reach the nerve. An assistant is instructed to hold the guide scrupulously in place and to give warning instantly if it is touched. The facial canal is sometimes deficient or destroyed, leaving the nerve exposed.

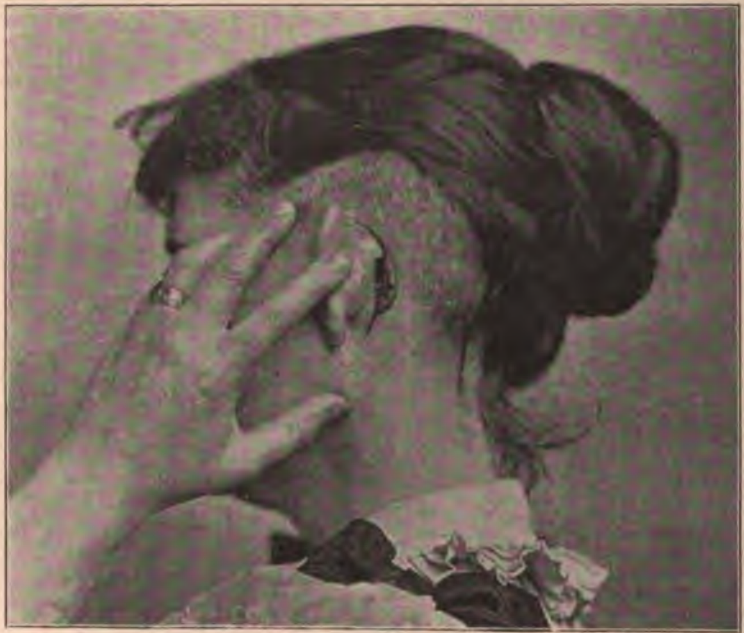


Fig. 224.—Appearance Two Weeks after the Modified Operation. (Author's Case.) Healed five weeks after the operation.

It is of the greatest importance to avoid injury of the facial nerve, as it produces a shocking deformity of the face (Fig. 186). I have seen facial paralysis produced even by packing the wound-cavity too firmly with gauze, producing pressure on the exposed nerve.

An anomalous position of the facial nerve renders it liable to injury if one chisels near the floor of the external canal. Hence, in certain cases the utmost care and skill on the part of the surgeon may not suffice to prevent facial paresis or paralysis, particularly when the walls of the Fallopian canal are congenitally deficient or have become impaired or destroyed by carious or necrotic processes. In using the middle-ear curette one should not forget that the tympanic walls are sometimes as thin as an eggshell (Figs. 214 and 222). The internal carotid artery and the internal jugular vein are sometimes very imperfectly protected and liable to be penetrated. As one proceeds upward and backward the external and posterior semicircular canals must be avoided.

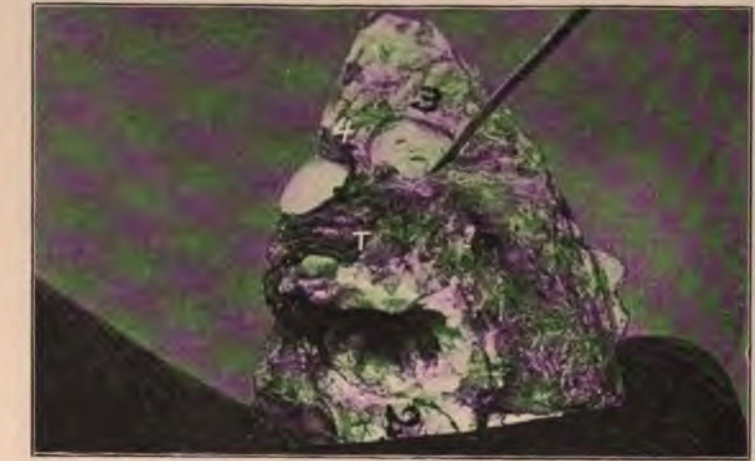


Fig. 225.—Post-mortem Section of Mastoid Process. (Author's Specimen.) *T*, Tip of process. 2, Fistula below *T* leading into mastoid cells. 3. Opening made by trephine, probe resting in antrum. 4, Cotton in external meatus.

The radical, or Stacke, operation consumes more time than the simple, or Schwartze, operation. The time varies with different operators from one to two hours. Longer time is required for healing also on account of the greater extent of wound-surface. Fig. 223 shows progress six weeks after the Stacke operation.

THE MODIFIED MASTOID OPERATION.

In this operation the incision is the same as in the radical one (Fig. 217). The writer does not dissect out the whole integumentary canal, but separates only its postero-superior half from the bony wall and then depresses it sufficiently to give easy access to the tympanic cavity. By this means one-half of the soft meatus is left undisturbed and the integrity of the integumentary canal is preserved. This method leaves a less extensive wound to heal, and it has afforded the most satisfactory results. The collapse of the canal can be prevented by lightly packing the mastoid wound and by packing the canal or inserting a firm-rubber tube. In other respects this method, which

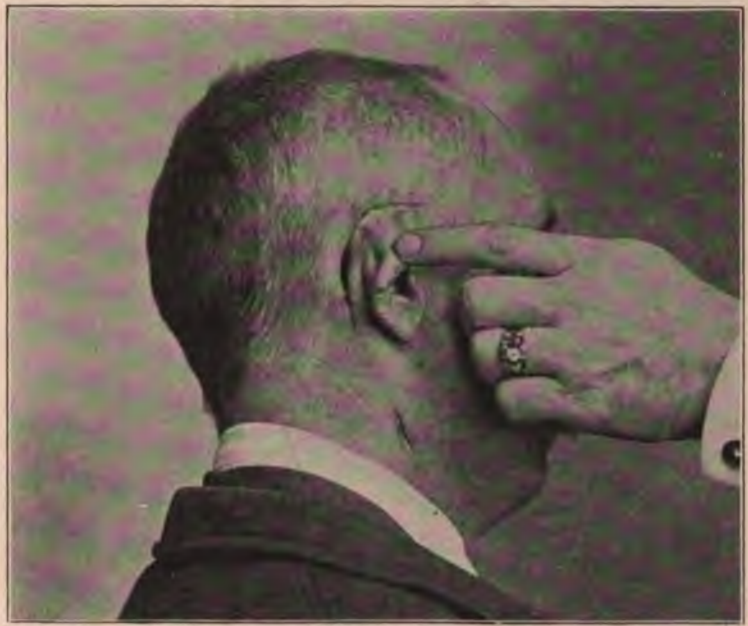


Fig. 226.—Appearance Three Weeks after a Modified Stacke and an Operation for a Neck-abscess. The latter is healed and the former kept open until the wound-cavity filled with healthy tissue. Patient discharged cured fifty-five days after operation.

the author has preferred for several years, corresponds to the Stacke operation.

It is safer not to close the wound entirely until it has healed from the bottom. When the interior has filled with firm cicatricial tissue up to the surface of the bone-opening it is safe to allow it to close. We have had good results after closing the wound completely at the end of the operation, but it is certainly not so safe a plan.

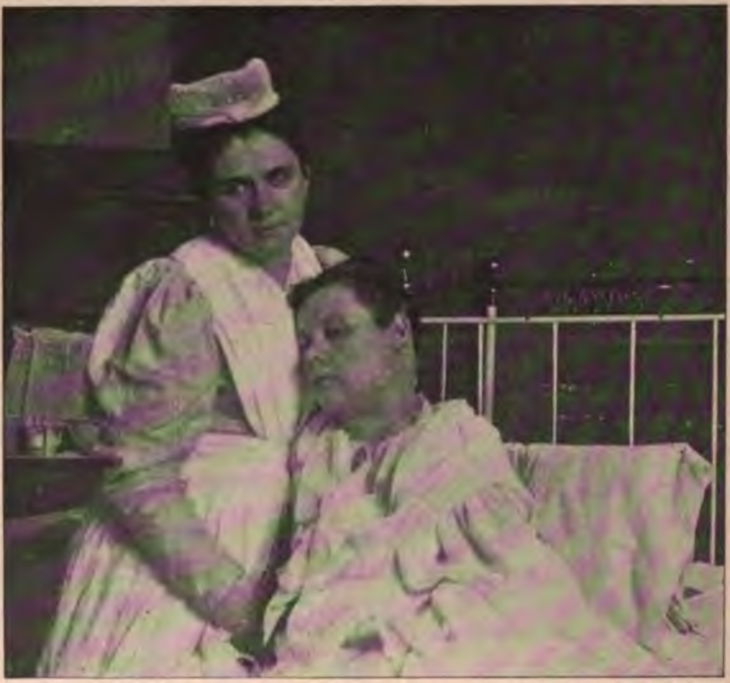


Fig. 227.—Abscess of the Mastoid Process Extending over Ten Weeks, resulting in an Enormous Abscess of the Neck, reaching Nearly to the Thoracic Cavity. (Author's Case.) Cured by an operation.

The best dressing is one of dithymol diiodide (aristol) sprinkled over the wound-surfaces, covering them entirely. Then iodoform gauze should be placed lightly in that part of the wound chosen to remain open. It should not be packed down to the bottom of the wound so firmly as to crowd any discharge inward, but it should fill the cavity and keep the cutaneous tissues from closing over the superficial opening in the bone. Dithymol diiodide has two excellent qualities: it is the best cicatrizant we possess, and it has the additional advantage of being to some extent an anæsthetic. While iodoform is irritant and toxic and boric acid sometimes produces pain, dithymol diiodide soothes without any ill effects.

After stitching that part of the wound to be closed, and dressing its open mouth for drainage, the whole is covered with sterilized gauze, absorbent cotton, and a net bandage. This bandage is made of the common white mosquito-cloth, which, as used in the Northern States, is sized with a preparation of glue. The roll of bandage is dipped in sterilized water just before applying, until it is wet through. Then the water is squeezed out and the bandage is applied as usual. When it dries, the layers adhere together firmly, so as to retain their position for several days in succession without any attention.

Fig. 228.—The Same as Fig. 227, showing the Outline of the Swelling.

This operation requires more time than Schwartze's and less than Stacke's, both to perform and for healing. Fig. 224 shows progress two weeks after the modified Stacke operation. Three weeks after the operation taste was suddenly lost, but returned again. The exuberant granulations seen on the right border of the wound were repressed with silver-nitrate stick.

ABSCESS OF THE NECK FROM MIDDLE-EAR AND MASTOID SUPPURATION.

This is an occasional complication that requires operative interference. It arises from the purulent process penetrating the bone and burrowing beneath the superficial or deep layer of muscles. If it break through the inferior wall of the tympanic cavity, the pus-channel may extend along underneath the deep layer of muscles even to the thoracic cavity. If it rupture through the anterior wall of the middle ear, a retropharyngeal abscess or a superficial cervical abscess may develop. When the pus breaks through the inferior surface of the mastoid process (Fig. 225), it burrows under the sterno-mastoid muscle and forms a swelling on the side of the neck. At first the tumor is small, is generally located directly below the lobule of the auricle, is hard to the touch, and may give so little evidence of its presence that it may be overlooked.

So slight are the symptoms at first that patients do not mention the neck trouble, and it is only by the habit of close observation that the surgeon himself does not let so serious a matter escape him. While no active symptoms referable to the neck-abscess may occur during the first few days, it often increases rapidly in size. The surrounding tissues become infiltrated; the tumefaction extends over a larger surface; the overlying skin becomes tense and shiny to such a degree as to suggest erysipelas; the movements of the head become restricted and painful; the temperature rises; the tongue becomes coated; headache, loss of appetite, and other febrile disturbances supervene. Although fluctuation does not occur early, especially if the abscess is deep-seated, the diagnosis is promptly suggested by the presence of the suppuration above it.

The only treatment is to open and evacuate the cavity and treat it antiseptically until pus formation ceases. Great care must be taken to avoid injury to the network of veins, arteries, and nerves in this region. For this reason it is best to open the abscess as far back as possible, and yet open it in a dependent position. Further treatment should be on general surgical principles.

Fig. 226 shows such a case three weeks after the modified Stacke operation and opening of the neck-abscess, the latter being entirely healed. A drainage-tube was inserted into the neck-opening, carried upward, and brought out through the mastoid wound.

Figs. 227 and 228 show an extraordinarily large abscess of the neck complicating mastoid and middle-ear suppuration. The swelling over the mastoid process is best shown in the front view. The great swelling of the neck is indicated by the curved line below the ear in the posterior view.

CHAPTER [illegible]

DISEASES OF THE INTERNAL EAR.

As compared with affections of the middle ear, diseases of the labyrinth are rare, except as sequels of tympanic diseases. The methods of making a differential diagnosis of diseases of these two parts of the ear are sufficiently set forth in the section on hearing-tests.

HYPERÆMIA AND ANÆMIA OF THE LABYRINTH.

Hyperæmia may occur as a result of middle-ear inflammation or some constitutional disease, or secondarily to a disturbance of the circulation in the blood-vessels of the neck, such as pressure on the large veins; or it may be due to certain medicines,—quinine, sodium salicylate, amyl nitrite, etc. It sometimes complicates the fevers.

Anæmia of the labyrinth may follow great hemorrhages, exhausting affections, and various anomalies of the circulation.

The symptoms need not necessarily include impairment of hearing, but tinnitus aurium and giddiness are the principal manifestations. These conditions will be recognized as accompaniments to the main disease which gives rise to them, and the diagnosis, prognosis, and treatment will be determined accordingly. If hyperæmia is due to acute inflammation of the middle ear, the measures laid down in the section on that subject should be brought into requisition: cocaine, heat, leeching, counter-irritation, catharsis, bromides, rest, the antiphlogistic diet, etc.

In anæmia of the labyrinth the primary condition that causes the anæmia will suggest the treatment.

INFLAMMATION OF THE LABYRINTH (OTITIS INTERNA).

Primary inflammation of the internal ear is of very rare occurrence; but a disease of the surrounding structures, the middle ear, or mastoid process may extend to the labyrinth. An intracranial lesion also may involve this organ. Predisposing causes are to be found in the loss of the stirrup, caries and necrosis of the inner wall of the tympanic cavity, etc., by means of which an entrance of bacteria and discharges is effected into the labyrinth.

Cases of primary labyrinthitis have been reported by Agnew, Schwartze, Webster, and others. Occasionally cases are seen in which, after a severe cold or some other cause, or even without any discernible cause, sudden deafness of greater or less degree comes on, without traces of middle-ear disease. Giddiness usually accompanies such attacks. The dizziness may disappear, leaving a permanent deafness. In case this deafness is due to a serous exudation into the labyrinth, producing pressure on the terminal filaments of the auditory nerve, the loss of hearing may not be complete or permanent. Absorption of the exudate may be followed by a clearing up of the subjective symptoms and deafness.

Purulent inflammation is of more serious import, since it not only robs the sufferer of the power of hearing, but jeopards his life. Besides the predisposing causes mentioned above, it is sometimes a result of the eruptive fevers, diphtheria, mumps, variola, typhoid fever, or cerebral meningitis. The latter disease is simulated by the most active form of primary labyrinthitis. The two are easily mistaken for each other, the symptoms are so similar, but the duration of the labyrinthal affection is but a small fraction of the other.

Panotitis, or inflammation of both middle and internal ears, is generally the result of scarlet fever or diphtheria, producing irreparable deafness and for some time a staggering gait. A separate description of this disease is not necessary, since it is a combination of two conditions already presented.

The prognosis of inflammation of the labyrinth is unfavorable. Some cases recover; more do not. One such case, complicated with mastoiditis, recovered entirely after four months, without mastoidectomy, although I was in doubt for a time if further postponement of the operation were justifiable. Another became entirely deaf during meningitis at the age of 2 years. During the sixth year she began to distinguish sounds. She has improved under treatment, and has learned to talk without special instruction or lip-reading. At the age of ten years improvement continued. She heard conversation well, and attended the public schools. The author has met with a number of such instances; yet it is safest to give a very guarded and conservative prognosis.

Treatment. — Potassium iodide, pilocarpine, iodine ointments, etc., have been used by Politzer, Moos, Gruber, and others. Of a 2-per-cent. solution of pilocarpine hydrochlorate, from 2 to 6 drops are injected into the forearm daily, in increasing doses. General antiphlogistic treatment must be resorted to in the acute stage, such as is detailed in the division on acute inflammation of the middle ear. In syphilitic infection the iodides and pilocarpine are indicated. In suppuration the methods given for middle-ear suppuration are applicable.

HÆMORRHAGE INTO THE LABYRINTH.

Extravasation of blood into the labyrinth may take place as the result of the same diseases that induce inflammation of this organ, as well as from atheromatous degeneration, fracture of the temporal bone, concussion, and necrosis. Resolution may take place by absorption, or an inflammatory process may be set up, with its train of consequences, or the clot may undergo organization.

MÉNIÈRE'S DISEASE.

Ménière first described a group of symptoms that characterized a case of effusion of blood into the labyrinth: deafness, vertigo, and vomiting. The attack comes on suddenly, the patient falling as in an epileptic seizure and presenting an appearance, on regaining consciousness, similar to one coming out of an epileptic fit. In addition to the symptoms mentioned, there may be subjective noises and total deafness. After consciousness returns and vomiting ceases, the great deafness, dizziness, and tinnitus aurium remain. Walking with the eyes closed is difficult and the body may incline toward one side. The mental faculties evince impairment.

Diagnosis.—This is based on the suddenness of the attack; the extreme loss of hearing without previous serious disturbance of function; the presence of a group of symptoms pointing, in unison, toward aural disease; absence of disease of the conducting apparatus or of any other structure than the auditory nerve.

Prognosis.—This, for the most part, is unhappy. The hearing may improve, but this is not likely. The dizziness soon diminishes sufficiently to allow the patient to walk, though unsteadily, and he staggers toward the side of the affected ear. The tinnitus may disappear, but is likely to continue indefinitely.

Treatment.—Rest in bed and perfect quiet are important. The bowels should be relaxed, an icebag (Fig. 194) applied to the mastoid, and a counter-irritant to the side and back of the neck. Potassium bromide and iodide in large doses and pilocarpine may be employed as directed for labyrinthitis. Charcot recommended quinine, but, since it produces labyrinthal congestion, it appears to the writer to be contra-indicated.

LEUCOCYTHÆMIC DEAFNESS.

Patients suffering from leucocythæmia are sometimes subject to sudden and complete deafness and vertigo, and even facial paralysis. The ear, like all other organs, is subject to hæmorrhagic and exudative processes, although it is not as frequently implicated as the eye. Inflammation may follow, resulting in proliferation of connective tissue or bony growths.

The Treatment consists in measures for the general condition and the remedies recommended in Ménière's disease.

SYPHILIS OF THE LABYRINTH.

Syphilitic lesions of the labyrinth are most likely to occur during the tertiary stage, but sometimes manifest themselves in the secondary period. The precise pathological changes in this disease are not yet clearly established. The symptoms are very similar to those characterizing Ménière's disease. In most cases subjective noises are added to the great deafness and dizziness. The affection is usually bilateral. Bone-conduction is diminished or destroyed. The presence of syphilitic lesions in other parts of the body, or a history of a previous infection, combined with the symptoms referred to, clear up the diagnosis. Of all children with inherited syphilis, 10 per cent. have ear trouble (Hutchinson and Jackson). Others claim as high as 33 per cent. The characteristic Hutchinson teeth should be looked for.

The prognosis is unfavorable. In recent affections and in young persons the prospects are more encouraging than in the severe types, with age and a generally impoverished condition to combat.

Treatment.—This is the same as for constitutional syphilis, with the addition of pilocarpine injections, in 2-per-cent. solution, of 4 to 12 drops in increasing daily doses. Any improvement to be had from the pilocarpine should show within two weeks. Edmund D.

Spear speaks highly of the results from subcutaneous injections of pilocarpine. The writer generally employs the mixed treatment,—mercury and potassium iodide combined.

Albert H. Buck cites a case of congenital syphilitic disease of the ears in a boy, giving rise rapidly to a high degree of bilateral deafness. The hearing was much benefited by treatment, which fact led the reporter to conclude that it was an instance of localized periostitis affecting either the internal surface of the cochlea or the articular borders of the stapes and oval foramen.

Toeplitz reported a case of aural syphilis in which "the labyrinth was affected primarily in the course of a freshly acquired case of syphilis. The aural affection began simultaneously with the appearance of roseola.

"The special features of this case are as follow: 1. The affection of the labyrinth occurred after the appearance of pharyngeal patches and simultaneously with the appearance of roseola. 2. The aural lesion took place during the secondary stage without attacking the middle ear. 3. The diagnosis of syphilis was made from the ear trouble.

"The pathological changes produced by the syphilitic poison, which entered the lymphatic and blood-current of the labyrinth from the pharynx through the aqueduct and the blood-vessels, probably consisted in inflammatory alterations of the membranous portion, the periosteum and the surrounding lymph of the vestibule, and the first turn of the cochlea, with an increase of cellular elements and hæmorrhages. All these changes disappeared after energetic antiluetic treatment."

Diseases of the Auditory Nerve.

The acoustic nerve may become the seat of various changes—hyperæmia, hypertrophy, atrophy, secondary inflammation, and suppuration—through invasion from the contiguous intracranial or tympanic structures. It must be admitted that the present state of our knowledge of these pathological processes affords no basis for a promising system of treatment.

NEUROSES OF THE PERCEPTIVE APPARATUS.

Hyperaudition. — A transitory increase in the intensity of the hearing-power affects some persons. For this condition the author proposes the term hyperaudition as conforming to our system of nomenclature and as being correctly and briefly expressive. This condition is a symptom of cerebral excitement or irritation, and may constitute a precursor of intracranial disease.

Hyperæsthesia.—Auditory hyperæsthesia is an insufferable sensitiveness to sounds or noises. Highly nervous subjects often present this anomaly, and it is an accompaniment of headaches and intracranial affections. It is often observed in sclerosis of the middle ear. The slamming of a door, the firing of a gun, etc., cause much more discomfort than in a state of health.

Paracusis.—This is a false perception of the pitch of sounds. The tone is heard by air-conduction generally higher than its true pitch, but may be heard lower. This may occur in one ear only, even when both are affected by sclerosis, and it is due to an abnormal tension of the transmitting mechanism. The writer has observed in such cases that certain tones only, and usually the higher, were thus incorrectly perceived by one ear, both being similarly diseased, while all tones were correctly heard by bone-conduction. The apparent alteration in pitch varies in different subjects from one-quarter to one-half tone, or even one or two tones. This trouble unfits a musician for any but solo-playing, and it may incapacitate him for that.

Double hearing has been observed in acute middle-ear inflammation. The tone was perceived as a primary, accompanied or followed by a secondary, sound, the latter being in the nature of an echo. This may be due to hearing correctly with the normal ear and incorrectly with the other.

Paracusis Willisii.—This is hearing better in a noise, and is pathognomonic of sclerosis. It is undoubtedly due to the fact that, when powerful sound-waves set the ossicles in vibration, the lesser vibrations are carried along with the greater to the perceptive organ. Once arrived at the latter point, the smaller waves are recognized with the larger (see chapter on "Sclerosis").

Subjective Sounds.—These are sounds experienced by the patient as real, but existing only in his own consciousness. They are not always referred to the ears, but to other parts of the head: the region immediately above the ears, the occiput, and even the vertex. They are due to irritation of the auditory nerve and possibly of the hearing-centre. Occasionally they are so intense that the sufferer is led to believe them to be objective sounds and that his friends ought to hear them by placing their ears close to his. They may become so unendurable as to cause melancholia and loss of sleep and memory.

Even in greatly impaired hearing and total deafness patients have declared to me that they would not care whether the treatment benefited the hearing, if only the interminable head-noises could be stopped.

It is sometimes imagined that insects have gained entrance into the ears, and the surgeon is importuned repeatedly to look for them, being assured that they must be found. One woman persisted in her declarations that there were crickets in her ears, for she could hear their constant chirping. Notwithstanding my examinations, and statements to the contrary, she filled her ears with spirit of turpentine to kill the crickets.

Very susceptible individuals may have their minds unbalanced by this harassing, unceasing din. We have seen instances in which subjective voices were heard, but they were hallucinations of hearing in persons of unsound mind. Whether the psychoses were attributable to the ear disease or whether the latter was merely a coincident could not be determined. The latter was probably true, and in such cases the tinnitus aggravated the mental aberration. Ear treatment may afford much relief in such nervous affections by removing the excitant of hearing-hallucinations.

There is a wide variation in the character of the subjective noises. Most people call it a ringing or tinkling of high pitch. In others it is like the roaring of water, the sighing of the winds, the rumbling of wagons, crackling or explosive sounds, or sudden changes from the usual ringing to a loud breaking forth of a tone, as if a small bell had been struck a hard blow. The pitch of the ringing in one ear may be in unison with a fork of 2048 vibrations, or the third C above middle C of the piano, while the pitch of the tinnitus of the other ear may be much lower and the sound of a different quality. Probably in most cases it is like the ringing produced by overdoses of quinine. There may be two different qualities of sounds in the same ear.

The noises are increased during a combination of low barometer with low thermometer, especially so when the air is very humid. Continuous cloudy or rainy weather and winds give rise to them. The same is true of quinine, sodium salicylate, alcoholic beverages, excessive tobacco-smoking, loss of sleep, sneezing, coughing, much use of the voice, very cold drinks or food, and a damp, cold, moldy atmosphere, such as is found in basements. On the other hand, warm, sunshiny weather diminishes the noises. They are less observed or entirely suppressed in the presence of objective sounds like those of an orchestra, the noises of the street or cars, etc. Often patients cannot tell whether or not the noises are present when objective sounds can be heard. When tinnitus first appears it may be intermittent, but in advanced sclerosis it becomes interminable. A certain tolerance of the noises is frequently acquired, so that they are not very much noticed when the individual is preoccupied or in a noisy locality; but in quiet surroundings the noises seem to besiege the brain again with redoubled intensity.

Nervous tinnitus aurium is an affection in which the ear is not of necessity involved. It may arise from reflex causes and requires general, rather than special, treatment. However, the ear should be inspected for any possible lesion.

Spasmodic noises, or those occasioned by spasmodic contractions of the muscles of the ear, are rare. In one case I could plainly see, synchronously with the clicking noises, a rhythmical movement of the drumhead,—excursions inward and outward,—undoubtedly occasioned by spasmodic contractions of the tensor tympani muscle. Spasmodic contractions of the Eustachian tubal muscles may cause snapping sounds. Mucous râles occur in the Eustachian tube and middle ear in the same manner as they do in the bronchial tubes. Circulatory disturbances of the heart, the internal carotid artery, or the arteries of the ear give rise to pulsating sounds in unison with the pulse.

Prognosis.—This depends principally upon the cause of the subjective sensations, but, excepting in sclerosis and diseases of the labyrinth and of the brain, the prospect of relief is good. The longer the noises have existed, and the more unvarying and continuous their character, the less promising is the prognosis.

Treatment.—Since tinnitus aurium is a symptom of various pathological processes, we can speak of its treatment here in a general way only, otherwise it would involve the measures necessary for the special treatment of all the causative conditions. These will be found in their proper divisions of the subject.

It is much more difficult to stop the noises than to improve the hearing. The latter often increases, while the noises prove intractable. We may diminish the noises or change their character, while we cannot by any known means eradicate them, in many cases. It is unwise to promise to cure or even to diminish them. In the majority of instances the tinnitus is a symptom of sclerosis. In addition to the treatment outlined for sclerosis the author has used counter-irritation with mustard or its oil, and has vesicated with cantharidal collodion. These applications sometimes produce a beneficial effect. When the tinnitus has continued after an acute inflammation of the middle ear has subsided, we have found medium doses of sodium bromide afford complete relief. This was attributed to its sedative effect on the labyrinthal irritation. Charcot and Guye have recommended quinine. It may prove serviceable in periodical tinnitus, but as it produces congestion of the middle ear and labyrinth, and, in large or continued doses, deafness, its utility in ear affections is very limited.

PARESIS AND PARALYSIS OF THE AUDITORY NERVE.

There are certain forms of paresis and paralysis of the auditory nerve that are so rarely met with as to merit only a passing notice in a work of such practical brevity as this. In some hysterical subjects anomalies of hearing and subjective noises occur, but in association with anæsthesia or hyperæsthesia of other parts of the body that indicate the character of the affection. These attacks are transitory and without apparent changes in that part of the ear that is accessible to inspection.

Treatment of these aberrations is largely based on the associated causative conditions; but, in addition to the general treatment, special measures may be employed by means of the ear-electrodes (Fig. 188). The writer has generally preferred the primary current of a faradic battery to the galvanic, for the former unites the properties of both currents, as he has shown in his batteries by means of the galvanometer. The negative pole is connected with the electrode that rests in the ear which requires stimulation or irritation. The current is turned on very mildly at first and gradually strengthened until it is as strong as can be comfortably borne, and continued for from six to ten minutes. By means of my electrodes the current is more limited to the ear than with the older kinds, which diffuse the current usually over the side of the head.

In using these electrodes it is not necessary to fill the meatus with water, as was the former custom, to the detriment of the drum-membrane, but the tips of the electrodes are moistened and covered with a moist layer of absorbent cotton.

In treating paresis or paralysis of the facial nerve after a mastoid operation the wound can be filled with wet cotton and the electrode placed in contact with it. This conducts the current to the injured nerve. The other electrode is held in contact with the opposite mastoid process. During a part of the treatment the electrode is removed from the opposite side and applied to the groups of muscles affected (Fig. 223).

CEREBRAL CAUSES OF DEAFNESS.

Cerebral deafness may arise in two ways: by a disease of the hearing-centres or by an extension of a disease of the brain or of the meninges to the origin or course of the acoustic nerve or to the labyrinth. The most frequent cause of intracranial deafness is meningitis. The loss of hearing may not become apparent at the time that it occurs, but it will be discovered when the patient regains consciousness. The destruction of hearing takes place within the first few weeks of the disease. This form of deafness is hardly amenable to treatment, the reason for which is apparent when we consider the pathological processes that destroy the function of the nerve: "Softening or thickening of the ependyma of the fourth ventricle, purulent infiltration and softening of the auditory nerve" (Knapp); "imbedding of the latter in meningeal exudation" (Schwartze); "shriveling of the nerve-stem, and purulent inflammation of the membranous labyrinth, the origin of which can be traced to transmission of the inflammation either along the sheath of the auditory nerve (neuritis descendens) or through the aqueducts" (Politzer).

The majority of cases of deaf-mutes coming under my observation in which the deafness was acquired were the result of meningitis. Politzer and Moos observed a staggering gait in half or more of their cases. We have not been able to verify the statement that tinnitus aurium is a frequent symptom, but most of my cases of deaf-mutes have been children, and they rarely speak of subjective noises.

Treatment will be considered only briefly, for its effects are unsatisfactory. If the patient is seen during the meningitis, the ice-bag (Fig. 194) should be applied over the ear as soon as there are aural symptoms. Later, if the deafness is not of too long standing, absorbents and alteratives should be tried, such as potassium iodide, and pilocarpine in a 2-per-cent. solution, from 6 to 10 drops at an injection.

Many pathological processes in the brain are capable of disturbing the hearing. It has been observed repeatedly that a disease of the left temporal lobe, involving the first convolution, produces word-deafness. In this peculiar state there is hearing for sounds, but incapacity for interpreting the compound sounds entering into the formation of words. This circumstance would tend to locate the cortical centre for hearing in this part of the brain.

The most frequent cerebral cause of deafness is the presence of tumors. The symptoms are very like those of labyrinthal disease: dizziness, tinnitus, varying degrees of deafness, and gastric disturbances.

The diagnosis is often impossible. In the case of a tumor, however, facial paralysis may develop, and bone-conduction may not be obliterated as it is in the labyrinthal deafness. Tumors may also produce pressure affecting other nerves besides the acoustic or facial. Anæsthesia of the skin of the corresponding side of the head is sometimes found. Symptoms pointing to involvement of the optic or other nerves may aid in arriving at a correct deduction.

New Growths of the Internal Ear.

New growths of primary formation in the internal ear have been met with but very infrequently, and clinically their consideration merits only brief mention. The presence of growths in this situation is usually due to an extension of epithelioma or sarcoma from the cranial or tympanic cavity.

CHAPTER XLIV.

DISEASES OF THE INTERNAL EAR *(Concluded).*

INJURIES TO THE LABYRINTH.

PENETRATING wounds of the labyrinth are of infrequent occurrence, but more often damage is done by fractures of the temporal bone, and concussion transmitted through the bones or through the air and conducting apparatus to the labyrinth.

The symptoms of fracture of the bone are: a flow of blood and serous fluid from the ear, inco-ordination, deafness, and vertigo. The symptoms of concussion are the same, with the exception of the bloody and serous discharges. The author has seen quite a number of instances in which the symptoms of irritation or paralysis of the auditory nerve supervened upon blows on the skull or on the ear. In the latter, rupture of the drumhead generally was present when the cases were seen early, and in such instances the labyrinthal symptoms were not as severe as when the drumhead was not ruptured, for in the latter case the force of the concussion was spent principally on the stirrup, probably impacting it into the oval window. I have examined many soldiers of the war between the States, who suffered more or less loss of hearing from concussions produced by cannons, exploding shells, etc., in battle. Instances have also come under my observation in which blows on the head from the "sandbags" of robbers, and from other weapons, and concussions from falls, have produced total deafness. Many workers in boiler-shops have appeared at the clinics with great dullness of hearing and tinnitus. Their ears were generally full of hardened, impacted plugs of black wax. After removing these the impairment of hearing still remained of high degree. Blacksmiths, tinsmiths, coopers, and iron-workers suffer similarly. This is due to the constant concussions of the drumhead, ossicles, and intralabyrinthal fluid and the auditory nerve from their incessant hammerings. The effect is to produce, in addition to the labyrinthal affection, the sclerotic form of middle-ear catarrh, which has already been considered.

Treatment of these forms of disturbances of hearing, of co-ordination, etc., is generally of little or no avail if several months or years have elapsed since the injury. In the early stage succeeding the concussion, the treatment laid down for tinnitus aurium and for paralysis of the acoustic nerve is indicated.

"J. A. Stucky, of Kentucky, reported a fracture of the base of the skull, producing deafness, tinnitus, vertigo, exophthalmos, facial paralysis, mastoiditis, aphasia, and unsteady gait, with recovery after a modified Stacke operation." ("Year-book of the Nose, Throat, and Ear," 1900.)

DEAF-MUTISM.

This is the lack or loss of speech due to congenital or acquired deafness. In my experience it is a rare condition. Only $^1/_2$ of 1 per cent. of all the cases of ear-defects that the writer has studied in hospital, dispensary, and private practice are of the deaf-mute class.

Pathology.—In congenital deaf-mutism the precise condition to which it is due cannot be determined. This subject presents an opportunity for the application of the theory of reversion as affecting types of degeneracy. It may be due to lack of development in some part of the organ of hearing, deformities of the fenestræ of the labyrinth, hydrocephalus, or pathological changes in the course or origin of the acoustic nerve. The acquired form may be due to middle-ear sclerosis, necrosis of the labyrinth, auditory neuritis, meningitis, or cerebritis. The tympanic and labyrinthal cavities may be entirely obliterated by connective-tissue and osseous proliferation. If the hearing is lost under the fifth year there is no speech, because it has not been acquired, while speech which has already been acquired later in life may be more or less perfectly retained after hearing is lost. However, I have many times observed that even in deaf-mute infants the primitive words "mamma" and "papa" only are uttered.

I have known dumbness to follow the loss of hearing even after speech was acquired. The ability to articulate words gradually declined until nothing more than mumbling and mouthing of unintelligible sounds remained. In about 50 per cent. of deaf-mutes the semicircular canals are affected, which accounts for their peculiar straddling gait, the feet being kept wide apart, and for their inability to stand with their eyes closed, and especially on one foot.

Among the 158 deaf-mutes of the institution for this class at Prague, Frankenberg (*American Medico-Surgical Bulletin*, December 10, 1897) found 94, or 59 per cent., with adenoid vegetations in the vault of the pharynx large enough to fill this space. Of these, 56 were boys and 38 girls. In 69 of these cases there were anomalies of the ears as follow: Impacted cerumen, 24; chronic suppuration with granulations, 14; sunken drumhead, 12; stenosis of the external meatus, 1; atresia of the meatus, 1; foreign body in the meatus, 1; adhesion of the drumhead to the internal wall of the middle ear, 1; hyperæmia of the drumhead, 4; dry perforation of the drumhead, 3; absence of the membrana tympani due to suppuration, 4; polypi, 3; mastoid cicatrix from periostitis, 1. Of these cases, 37, or 53.6 per cent., had adenoids.

These facts indicate the importance of examining for these growths in children having ear affections. Arslan found 6 deaf-mutes among 426 cases of adenoids, and cured one and relieved another, with respect to both the hearing and speech, by the adenoid operation.

In 118 autopsies on deaf-mutes performed by Mygind there were evidences of middle-ear diseases in 79. There were only 19 that were free from pathological conditions of the labyrinth or nervous centres. "In most of the cases the changes were due to severe and extensive inflammations, especially in acquired deaf-mutism. Other anomalies were almost identical in the two classes of cases, congenital and acquired. The opinion hitherto accepted that deaf-mutism results from congenital deafness, due to some anomaly of development of the organ of hearing, is invalidated by the fact that anomalies are of very great variety. Changes usually affect both ears, though unequally. The middle ear has been found most often affected. The internal ear was affected most in the semicircular canals, rarely in the vestibule; and in a great number of deaf-mutes these anomalies could be considered the chief cause of the deaf-mutism. In some cases the auditory nerve presented phenomena of atrophy and degeneration, but more often the nerve was intact. In some cases there were anomalies of the brain." (*Medicine*, January, 1898.)

Etiology.—Congenital deaf-mutism may be due to heredity, but it is not a frequent occurrence. A constitutional predisposition to this defect exists in some families, several members of which are afflicted. In one family the healthy parents had five daughters with normal senses and six sons who were born deaf (Kramer). Among all the deaf-mutes the writer has examined he does not know of one whose parents were deaf-mutes, although some have had various middle-ear affections. Consanguineous marriages, as well as specific disease and intra-uterine influences, are believed to account for deaf-mutism in quite a large proportion of instances. The acquired form may follow injuries during childbirth or infancy, meningitis, scarlatina, typhoid, diphtheria, mumps, syphilis, or inflammation of the labyrinth. I have not seen the epidemic influenza, or grip, given as a cause, but I have had occasionally under treatment the case of a girl, 6 years old, who had lost her hearing entirely for four years in consequence of an attack of the grip. Under treatment the hearing returned sufficiently to enable her to hear ordinary conversation and to learn to speak intelligibly. Inspection revealed no change in the drum.

Symptomatology.—In infants the defect is not likely to be discovered until about the time that children begin to talk, and even then it may be overlooked by the parents, who attribute the backwardness to slow development. We have often observed that parents believed their children could hear and that some defect in the organs of speech accounted for its absence, and yet they were born deaf-mutes. Failure to respond to sounds and calls can be easily detected if tests are made in such a manner as not to attract the child's attention by movements within the range of vision. Calling its name from behind, clapping the hands in such a position as not to produce waves of air that will strike the child, and out of its sight, the tuning-forks (Fig. 120), the Delstanche whistle, etc., are conclusive. If the child hear vowel or other sounds, a change of expression, a lighting up of the countenance, smiles, etc., evince the fact.

Diagnosis.—The means of diagnosis have been indicated above. In a large proportion of cases a modicum of hearing is present. The ability to say "mamma" is not significant, since it is frequently present in hopeless cases. Such sounds are primordial and are uttered by the lower animals.

Prognosis.—While the writer has seen apparent improvement in a few cases of congenital deaf-mutes, it has not been of such a degree as to admit of understanding the common conversational tone. Loud sounds and some words could be appreciated, without doubt, but even this slight gift proved a pitiful source of happiness. A few cases are on record in which there was a useful development of the hearing after about the sixth year or after puberty. The acquired form is generally regarded as less promising still.

Treatment.—In many cases examined by me there were evidences of middle-ear dry catarrh, but whether this bore any significant relation to the absence of hearing-power was a debatable question. It is possible that middle-ear disease in early infantile life may have involved the labyrinth in a destructive inflammatory process; or, if the labyrinth has escaped, connective-tissue proliferation or osseous growths may have obliterated the round window and may have anchored the stirrup in the oval window so firmly as to preclude the possibility of its vibratory movements in response to sound-waves. If the auditory nerve is not destroyed, bone-conduction of sound can be demonstrated. In that case inflation of the middle ear and the application of the massage otoscope (Fig. 114), together with the galvano-faradic current (Fig. 188), may demonstrate the possibility of improvement after a few weeks. In one case of a young man with greatly thickened and retracted drumheads, I resected parts of them, which resulted in a considerable improvement. He had already been able to perceive the sounds of the vowels, and after the operations he acquired the use of quite a number of words before leaving the city.

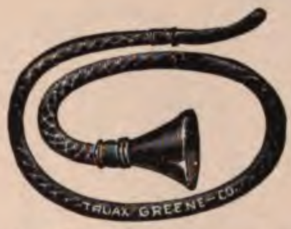


Fig. 229.—The Conical Conversation-tube.

Special instruction of deaf-mutes should begin as soon as it is shown that there is no hope for the hearing. The younger the pupil, the greater the accomplishment in the schooling. During the World's Fair in Chicago great proficiency was shown in the attainments of very young children in lip-reading and articulate language in the school-exhibits of those who had never heard. The perfect discipline was something to be appreciated by those who have had much experience with the deaf-mute class. Indeed, the author has often been led to a correct diagnosis in deaf-mute children before an examination was made, and before any information was imparted, by their irritable temper and incoherent violent actions. Lip-reading and articulate speech should always be taught them, if possible, and the sign-language should be made an accessory. Some children do not acquire the former; so the latter must be employed. The admirable schools for the deaf in Chicago and other large cities go further and impart a useful education and more or less manual training in order to render their graduates self-supporting.

M. A. Goldstein has published (*The Laryngoscope*, June, 1897) the excellent results obtained by the method of Urbantschitsch in persistent teaching of deaf-mutes by speaking vowel sounds, consonants, and their varying combinations into their ears until they are able to understand and repeat words and sentences. The author can recommend this method from practical experience with it.

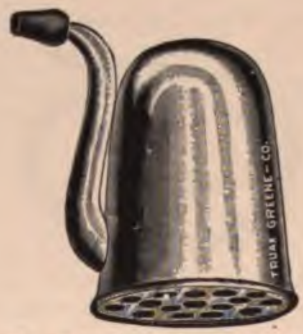

TRUAX GREENE-CO.

Fig. 230.—The London Horn.

The education of the deaf should be no more neglected than that of the better favored of our race. Indeed, greater facilities should be afforded for the acquisition of an education and the acquirement of the prerequisites of good and useful citizenship, to counterbalance the unfortunate disadvantage at which they have been placed through no fault of their own. The means already enumerated are efficient. They are provided by private and public schools in the cities, and by the States in their deaf-and-dumb asylums. The formation of classes in the public schools of cities for the instruction of partially deaf children is advocated by H. A. Alderton (*The Laryngoscope*, August, 1896). The subjects are usually intelligent and quick-witted, and their proper care and training will insure adequate returns upon the investment from both economic and humanitarian considerations.

HEARING-INSTRUMENTS.

Of all the various devices for aiding the hearing two only have proven of actual practical value in my experience. They are the conical conversation-tube (Fig. 229) and the London horn (Fig. 230). The conversation-tube consists of a trumpet-shaped mouth-piece to collect the sound-waves, connected with an ear-piece—both being of hard rubber—by a conical, elastic, spiral-wire tube covered with rubber and woven silk. The mouth-piece is placed close to the lips of the speaker, when a low, conversational tone can be employed, enabling the listener to hear words that are inaudible to others. The speaker should never talk loudly or cough or clear his throat with the mouth-piece near his lips, for often the hypersensitiveness of the affected ear renders these harsh, explosive sounds painful and irritating. These tubes are generally worn about the neck, under the coat, or rolled up in the coat-pocket. For near conversation they are, by far, superior to any other device.

The London horn (Fig. 230) is an excellent instrument for use at long distances, as in the church or lecture-room. It is made in three sizes and painted a dead-black preferably. The nickel-plated instruments are far more conspicuous. The horn is applied to the ear as in the case of the tube, and the large, open end is directed toward the source of sound. There is one serious objection to the metal horns: they convey a metallic, adventitious sound along with the principal sound. This defect is especially noticeable in listening to singing and the playing of an orchestra. However, it is preferred to the tube by many. The most distinguished of American newspaper editors was entirely dependent upon it, and could not be prevailed upon to try the tube.

After an extensive destruction of the drumhead the hearing is sometimes much improved by placing a pledget of cotton lightly against the handle of the mallet. Sound-waves striking this are then communicated to the ossicles and so transmitted to the perceptive apparatus. In such cases the artificial ear-drum, consisting of a thin disc of soft rubber (Turnbull's) is inserted into the meatus and nicely adjusted to the exposed mallet.

The audiphone, consisting of a fan-shaped disc of vulcanized rubber, bent by a silken cord into a convex surface to be presented toward the source of sound, the edge in contact with the upper teeth, has been used to some extent. The writer has tested it with numerous patients, but with few exceptions it was of little value.

The rubber disc, apparitor auris, cornets, auricles, cones, etc., made of soft rubber and advertised extensively in the newspapers, are generally of no use to patients, and are provocative of irritation, inflammation, and even ulceration of the canal and tympanic membrane and cavity. Occasionally we have been told by the wearers that their hearing was better while these devices were in their ears. We have frequently found them in contact with the drumhead, bathed in decomposing pus.

No efficient and harmless hearing-instrument for wearing in the ear has yet been devised. Fame and fortune await the inventor of the aural equivalent of spectacles. Alexander Graham Bell related to me that he discovered the useful principles of his telephone while endeavoring to invent a microphone to aid the deaf to hear. In response to my question, "Do you not consider it possible to construct an instrument for defective hearing that will be comparable to the lens for defective vision?" Mr. Bell replied, "I will not say that it is impossible; but, in the present state of our knowledge, it is improbable."

CHAPTER XLV.

LIFE-INSURANCE AFFECTED BY DISEASES OF THE EAR, NOSE, AND THROAT.

THERE are certain diseases of the ear, nose, and throat that would unquestionably deter any competent examiner for life-insurance from accepting risks in which they were involved. Such diseases, for example, are lupus, carcinoma, cholesteatoma, and tuberculosis. Tertiary syphilis, especially when the middle ear or the larynx is invaded, would be a valid cause for rejection of a candidate for life-insurance. This disease, on the one hand, may invade the labyrinth and even the more vital structures in the cranial cavity, or, on the other, its existence in the larynx threatens the deeper tissues, endangering life by strangulation from an exfoliated necrosed cartilage or by a final stricture of the larynx.

There are other diseases in respect to which there may be an honest difference of opinion as to their vitiating effect upon the application for insurance, and it is more particularly such as require a special knowledge and practical experience that we will consider.

The external ear is occasionally the seat of pathological conditions that are apparently innocent in their incipiency, although they pursue a steady course to the development of a malignant disease with a fatal termination. A person may complain of nothing extraordinary relative to the ear beyond insignificant sensations of uneasiness and itching at some point which is slightly more prominent than the surrounding surface. Close examination may reveal a little thickening of the integument, possibly an abrasion produced by scratching. These points are easily overlooked by one who is not alert to the fact that lupus and carcinoma have their beginnings in such unsuspicious symptoms. Moreover, the patient's habit of scratching a given point and the resulting irritation may, according to Virchow, convert a benign neoplasm into a malignant growth.

We may pass over the subject of acute inflammatory conditions, since no examiner would be expected to accept such risks.

The effect of a chronic dry catarrhal inflammation of the middle ear on life-insurance is a question of considerable interest. Experience has demonstrated that persons who are afflicted with such a disease generally enjoy immunity from acute inflammatory attacks, and from suppurating processes in the middle ear. We very rarely observe a case in which an acute inflammatory action or a suppurating process supervenes upon a chronic non-suppurative inflammation of long standing. But another important question relates to the possibility of life being shortened, not by the disease itself, but by accidents that are rendered more liable to occur by reason of the impaired hearing which the disease produces. Occasionally it happens that a person is run over by cars or other vehicles in consequence of an inability to hear their approach. There can be no sincere difference of opinion with respect to the greater liability to injury or death from such causes among those who suffer from a high degree of deafness; but many of this class are gifted with a compensating acuteness of vision and a quick, high order of intelligence which counterbalance their hearing-defect to a large extent. It is evident, then, that the examiner should estimate, not only the amount of impaired hearing, but should also take into account the keenness of sight and the intelligent alertness of the person. If he be dull mentally, slow to see, think, and act, he may be expected to become the easy victim of a careless driver or engineer; but if he possess an active muscular system well under the control of a vigorous mind, supplemented by normal vision, he may be relied upon as being quite capable of taking care of himself.

Furthermore, a distinction must be made between the hypertrophic or secretive form of inflammation of the middle ear, and the adhesive or sclerotic form. Although the former may be but a precursor of the latter, in itself it is a much milder disease and is susceptible of far more brilliant results from treatment. One may have the first, or milder, form for many years without suffering the extinction of a large proportion of his hearing; but sclerosis causes a great loss of the hearing power.

Chronic suppurative inflammation of the middle ear in an applicant for life-insurance, aside from the resulting deafness, is a subject that cannot be lightly passed over. Examiners appear to exercise especial care in such cases. The author has observed repeatedly that life-insurance examiners have insisted that persons with discharging ears must have the suppuration cured before their applications would be accepted. While writing this a patient has just complied with an insurance examiner's requirement that he present a statement from the author certifying that the suppuration of his middle ear had been cured, notwithstanding the fact that it had ceased a year ago, and the ear had remained well ever since.

In another instance an examiner refused to accept an applicant for life-insurance because he had a chronic suppuration of the middle ear, but stated that the application would be favorably acted upon if the ear were cured. Examination revealed granulations, necrosed ossicles, and carious tympanic walls, causing a foul discharge. The writer removed the granulations and ossicles and curetted the carious bone; a cure resulted and the patient secured his insurance policy. That the insurance examiner's judgment was sound is evidenced by the fact that such cases tend strongly toward mastoid involvement, and that the patient still remains well after the lapse of six years. These instances are fair examples of the care and intelligence manifested by the medical examiners in protecting their companies against loss.

On account of the vast possibilities of damage from suppuration of the middle ear it becomes a matter of the highest importance to the insurance companies. While the disease is easily curable if treated properly in its early stages, if neglected it not only jeopards the general health, but imperils life itself. The mucous membrane lining the tympanic cavity, which is the structure inflamed, serves the double purpose of a mucous lining of this cavity and also of a periosteum. Therefore, it is so closely related to the bone that the latter is prone to become involved in the inflammatory process. The pneumatic spaces of the mastoid process are lined by mucous membrane, which is a continuation of the membrane lining the middle ear; hence by continuity the inflammation extends from the tympanic attic through the aditus ad antrum into the mastoid antrum and cells. It is probable, in view of the relations of these cavities to each other, that whenever there is pus in the middle ear there is pus in the mastoid antrum also.

Having in mind the conditions just described, it is not difficult to comprehend the far-reaching consequences of a suppurative inflammation of the middle ear and the mastoid process. The pus, breaking through the confines of the softened bone upward through the roof of the tympanic cavity, reaches the middle cranial fossa, producing a subdural or cerebral abscess or meningitis; breaking forward it forms a retropharyngeal abscess, which may break suddenly into the pharynx and fill the larynx with pus, producing strangulation;

breaking downward it may burrow beneath the deeper layer of the muscles of the neck until it reaches the thoracic cavity; breaking backward from the mastoid cells, the pus empties into the posterior cranial fossa or into the lateral sinus. In the latter event pyæmia and phlebitis and thrombosis of the sinus may result. Without prompt and skillful surgical interference the fatal character of these conditions is unquestionable.

That it is well worth the while for medical examiners for life-insurance companies to attach sufficient importance to diseases of the ear is aptly illustrated by the experience of J. Morrison Ray (*The Laryngoscope*, August, 1897), who reported that out of 350 ear cases treated during the preceding year there were 6 fatal cases following suppuration of the middle ear.

Diseases of the nose do not often prove fatal. Lupus, syphilis, and tuberculosis of this member are generally secondary to the occurrence of these diseases in other locations. Carcinoma and sarcoma are rare in this part of the economy, and the examiner is not very likely to find causes here for the rejection of an applicant, unless they are merely associated with the same causes in adajcent structures. However, one should be slow to accept an applicant who has a purulent discharge from his nose while such discharge continues, since it might be the result of a purulent inflammation of the ethmoid cells or the frontal sinuses, which are in close relation to the meninges of the brain; or it might indicate empyæma of the maxillary antrum. Fibroma of the naso-pharynx would be a sufficient cause for rejection.

If an applicant be subject to frequently recurring attacks of sore throat, especially every spring and fall, it should suggest rheumatic sore throat, and a possible rheumatic heart affection. The throat ought to be inspected for tubercular, syphilitic, or cancerous lesions; and one should not forget that the ravages of syphilis in the throat may reach an appalling extent without the patient complaining much of pain, and that the tonsils are sometimes the portal of entrance of tubercle bacilli into the system.

The larynx is often the seat of tubercular manifestations, but these are so often secondary to pulmonary infection that they are quite likely to be suggested by an examination of the lungs. But one must not be thrown off his guard by this fact, for instances of primary laryngeal tuberculosis are not infrequent, and the larynx should be examined in every case in which hoarseness, difficulty of deglutition, and soreness in the region of the throat are found. The existence of tumefaction or ulceration in the larynx is sufficient cause for either rejecting the applicant or for holding his application without action until the abnormal condition is corrected or shown to be innocent beyond a reasonable doubt. A course of the iodides may demonstrate that the lesion is syphilitic and in a curable stage, or it may reveal a tubercular or carcinomatous incurable disease. Even in this test one may be easily deceived unless he remembers that carcinoma may improve temporarily under the iodides; but the improvement is transitory only, and is lost as the case progresses, while in syphilis the benefit remains and increases with a marked betterment of the general health.

There is a common belief among those who are not well read in medical matters that the existence of a catarrhal condition of the upper respiratory tract is necessarily a forerunner of grave lung lesions. This fallacious notion is propagated with cunning zeal by the advertising medical charlatans for commercial reasons. The suggestiveness and plausibility of the idea render its exploitation an easy and profitable source of practice. They find the public mind ready to accept the belief that a catarrh of the nose and throat is almost certain to eventuate in consumption of the lungs.

There is enough of the element of truth in such notions to be useful to the honorable practitioner, and to be susceptible of gross abuse at the hands of the mountebank. Certainly there is more likelihood of a bronchitis or pneumonia occurring in a person of a pronounced catarrhal type than in one who "never takes cold." So, too, there is more liability of finding a rheumatic lesion of the heart in one who is subject to attacks of rheumatic laryngitis or pharyngitis. Indeed, there are subjects in whom a severe attack of pharyngitis or laryngitis almost invariably either terminates in bronchitis or evinces a very strong tendency to do so. A uric-acid diathesis should be looked for and corrected if found in applicants for life-insurance. Inquiries ought to be made with reference to their being subject to even slight onsets of rheumatism, neuralgia, migraine, sore throat, or symptoms of gout. The possibility of the development of angina pectoris should not be overlooked, since it is the result of uricacidæmia; and, besides the aids already suggested as afforded by the condition of the upper respiratory tract, the examiner should be influenced by the evidence of hay fever and asthma, which are distinctly neuropathic diseases of a gouty origin.

APPENDIX.

REMEDIES.

The composition of the remedies mentioned has been given according to the best information that could be obtained.

Sprays.

Lavolin: a liquefied vaselin without color, taste, odor, or irritating properties.

Benzoinol: a product similar to lavolin, with the addition of benzoin.

Camphor-menthol, pure: the liquid product resulting from bringing together equal parts of camphor-gum and menthol crystals without heat ($C_{10}H_{18}O$).

Micrazotol contains boroglycerid, eucalyptol, thymol, resorcin, menthol, and benzoic acid. (Acid reaction.)

Listerin contains the essential antiseptic constituents of thyme, eucalyptus, baptisia, gaultheria, and mentha arvensis in combination. Each fluidrachm also contains two grains of refined and purified benzoboric acid.

Pasteurin contains the active principles of cassia zelanicum (*Lauraceæ*), eucalyptus (*Myrtaceæ*), gaultheria (*Ericaceæ*), menthol combined with boroglycerid, and 0.3 per cent. of formaldehyde. (Acid reaction.)

Formolid contains formaldehyd, acetanilid, boroglycerid, benzoborate of sodium, eucalyptol, thymol, menthol, oil of gaultheria, witch-hazel, and alcohol. (Acid reaction.)

Borolyptol consists of 5 per cent. of acetoboroglycerid, 2 per cent. of formaldehyd, in combination with the active antiseptic constituent of pinus pumilio, eucalyptus, myrrh, storax, and benzoin. (Acid reaction.)

Glycothymolin contains sodium, boric acid, benzoin, salicylic acid, eucalyptol, thymolin, menthol, and pine. (Alkaline reaction.)

℞ Camphor-mentholis, 3 per cent.
Lavolinis, 97 per cent.—M.

℞ Camphor-mentholis, 5 per cent.
Lavolinis, 95 per cent.—M.

℞ Camphor-mentholis, 10 per cent.
Lavolinis, 90 per cent.—M.

℞ Olei cubebæ, 4 per cent.
Benzoinolis, 96 per cent.—M.

℞ Camphor-mentholis, 10 per cent.
Olei cubebæ, 90 per cent.—M.

℞ Eucalyptolis, 3 per cent.
Olei picis liquidæ, 3 per cent.
Lavolinis, 94 per cent.—M.
—M. R. Brown.

℞ Salolis, 4 per cent.
Mentholis, 4 per cent.
Lavolinis, 92 per cent.—M.

℞ Olei eucalypti, 1 per cent.
Thymolis, 1 per cent.
Mentholis, 3 per cent.
Olei gaultheriæ, 1 per cent.
Lavolinis, 94 per cent.—M.

℞ Olei cubebæ, ℥ss.
Camphor-mentholis, ʒss.
Olei eucalypti, ℥ss.
Olei gaultheriæ, ʒij.
Lavolinis, ℥iij.
(Use the pure camphor-menthol.)

℞ Thymolis, gr. x.
Eucalyptolis, gr. xx.
Mentholis, gr. xxx.
Olei cubebæ, gr. xl.
Benzoinolis, ℥iv.
Olei rosæ, q. s.—M.
—O. B. Douglas.

℞ Eucalyptolis, 4 per cent.
Benzoinolis, 96 per cent.—M.

℞ Mentholis, 3 per cent.
Lavolinis, 97 per cent.—M.

℞ Olei pini sylvestris, 4 per cent.
Benzoinolis, 96 per cent.—M.

℞ Iodini,
Acidi carbolici, of each, gr. ij.
Benzoinolis, ℥j.—M.

℞ Olei pini sylvestris, min. xxx.
Olei eucalypti, ʒj.
Olei gaultheriæ, min. xxx.
Camphor-mentholis, ʒj.
Terebinthinæ Canadensis, ʒj.
Tincturæ benzoini, q. s. ad ℥iv.—M.

℞ Iodini, gr. xx.
Acidi carbolici, gr. xij.
Camphor-mentholis, ʒj.
Lavolinis, q. s. ad ℥iv.—M.

℞ Calendulæ, 4 per cent.
Hamamelidis, 8 per cent.
Pini strobi, 8 per cent.
Lavolinis, 80 per cent.—M.

Infusion of the flowers of calendula and the leaves of hamamelis with lavolin.

℞ Salolis, 3 per cent.
Olei gaultheriæ, 4 per cent.
Thymolis, 3 per cent.
Benzoinolis, 90 per cent.—M.

℞ Aristolis, 10 per cent.
Mentholis, 3 per cent.
Benzoinolis, 87 per cent.—M.

℞ Aristolis, 5 per cent.
Mentholis, 8 per cent.
Benzoinolis, 87 per cent.—M.

℞ Creasoti, 4 per cent.
Acidi carbolici, 3 per cent.
Olei picis liquidæ, 3 per cent.
Olei gaultheriæ, 4 per cent.
Benzoinolis, 86 per cent.—M.

℞ Acidi borici,
Sodii bicarbonatis,
Sodii chloridi, of each, ʒij.
Glycerini, ʒiij.
Aquæ rosæ, ℥iv.
Aquæ, q. s. ad Oj.
M. Filter.

℞ Iodoformi, gr. ij.
Benzoinolis, ℥j.—M.

℞ Camphor-mentholis, 3 per cent.
Olei pini sylvestris, 2 per cent.
Eucalyptolis, 1 per cent.
Benzoinolis, 94 per cent.—M.

℞ Sodii chloridi, ʒj.
Sodii phosphatis, gr. ij.
Sodii sulphatis, gr. xij.
Potassii sulphatis, gr. ij.
Potassii chloridi,
Potassii phosphatis, of each, gr. iij.
Mentholis, gr. j.
Glycerini, ʒiij.
Aquæ, q. s. ad Oj.—M.

℞ Acidi tannici, gr. xl.
Acidi gallici, gr. xx.
Sodii bicarbonatis, ʒss.
Aquæ, Oj.—M.
—SAJOUS.

℞ Sodii chloridi,
Sodii bicarbonatis,
Sodii biboratis, of each, ʒj.
Aquæ, Oj.—M.

℞ Sodii biboratis,
Sodii bicarbonatis, of each, ʒij.
Acidi carbolici, gr. xlviij.
Glycerini, ʒiiiss.
Aquæ, q. s. ad Oj.—M.
(Dobell's solution.)

℞ Sodii biboratis,
Sodii bicarbonatis, of each, ℥j.
Sodii benzoatis,
Sodii salicylatis, of each, gr. xx.
Eucalyptolis,
Thymolis, of each, gr. x.
Mentholis, gr. v.
Olei gaultheriæ, gtt. vj.
Glycerini, ℥viiiss.
Alcoholis, ℥ij.
Aquæ, q. s. ad Oxvj.—M.
(Seiler's solution.)

℞ Acidi carbolici, gr. xx.
Sodii boratis,
Sodii bicarbonatis, of each, ʒj.
Glycerini,
Aquæ rosæ, of each, ℥j.
Aquæ, q. s. ad Oj.—M.
—LEFFERT.

℞ Antinosinæ, gr. v.
Aquæ, ℥j.—M.

℞ Zinci sulphatis, gr. xv.
Thymolis, gr. $^{1}/_{8}$.
Alcoholis,
Glycerini, of each, ℥iss.
Aquæ menthæ piperitæ, ℥x.—M.

℞ Pulveris aluminis, gr. v-xxx.
Aquæ, ℥j.—M.
—J. Solis-Cohen.

℞ Antipyrinæ, gr. xv.
Aquæ, ℥j.—M.

℞ Aristolis, 5-10 per cent.
Ætheris, 95-90 per cent.

M. Signa: Spray for tuberculous ulcers.

℞ Morphiæ sulphatis, gr. iv.
Acidi tannici,
Acidi carbolici, of each, gr. xxx.
Aquæ destillatæ, of each, ℥ss.

M. Signa: Spray for tubercular ulcers.

℞ Sodii boratis, gr. v.
Aquæ rosæ, ℥j.—M.

Steam-inhalations.

Infusion of opium, ʒi-Oj.

Infusion of belladonna, ʒi-Oj.

Infusion of hyoscyamus, ʒi-Oj.

Infusion of conium, ʒi-Oj.

Compound tincture of benzoin, a teaspoonful to the pint of hot water.

Pure camphor-menthol, gtt. x to the pint.

Glycerinum acidum carbolicum, a teaspoonful to the pint.

℞ Glycerini, ℥j.
Aquæ calcis, ℥iij.

M. Signa: Use in a steam-atomizer.

℞ Acidi carbolici,
Zinci sulphocarbolatis, of each, ʒj.
Glycerini, ℥j.
Aquæ, q. s. ad ℥iv.

M. Signa: Use in a steam-atomizer.

Antiseptic and Astringent Solutions, etc.

℞ Acidi borici, gr. xx.
Aquæ rosæ, ℥j.—M.

(For the ear.)

℞ Acidi borici, gr. x.
Aquæ destillatæ, ℥j.—M.

(For the eye.)

℞ Zinci sulphatis, gr. ij.
Acidi borici, gr. x.
Aquæ destillatæ, ℥j.—M.

(For the eye.)

℞ Zinci sulphatis,
Acidi carbolici, of each, gr. viij.
Glycerini, ʒj.
Aquæ, ℥ij.—M.

(Ear-lotion.)

℞ Acidi borici, gr. xx.
Alcoholis, ℥j.—M.

(For the ear when granulations are present.)

℞ Sodii bicarbonatis, gr. xx.
Glycerini, ʒij.
Aquæ, ʒvj.

M. Signa: Use (warm) in the ear to soften cerumen.

℞ Acidi borici, gr. xv.
Aquæ rosæ, ℥j.—M.

℞ Hydrargyri bichloridi, gr. j.
Aquæ cinnamomi, ℥x.

M. Filter.

℞ Hydrargyri chloridi corrosivi, ʒj.
Acidi tartarici, ʒv.
Aquæ, q. s. ad ℥iv.

M. Signa: Ounce ss ad Oj aquæ (1 to 1000).

℞ Hydrargyri chloridi corrosivi,
Sodii chloridi, of each, ʒj.
Aquæ, q. s. ad ℥j.

M. Signa: Drachm j ad Oj aquæ (1 to 1000).

℞ Hydrargyri chloridi corrosivi, ʒj.
Ammonii chloridi, gr. xxxij.
Aquæ, q. s. ad ℥j.

M. Signa: Drachm j ad Oj aquæ (1 to 1000).

Iodoformi, 20 per cent.
Alcoholis, 80 per cent.—M.

Hydrargyri bichloridi, q. s. ad 1-5000 in aquam.

Acidi carbolici, ʒvj.
Aquæ, q. s. ad Oj.—M.

℞ Acidi carbolici, ʒj.
Olei olivæ, ʒx.
M. Signa: Carbolized oil.

Hydrozone: a 30-volume dioxide (peroxide) of hydrogen: H_2O_2.

Glycozone, a chemically pure, anhydrous glycerin saturated with ozone gas at 0° C.; powerful non-toxic, non-irritating germicide.

℞ Creolinis, ℥j.
Signa: Drachm i-vj ad Oj aquæ.—Esmarch.

℞ Acidi borici, ʒiv.
Aquæ destillatæ, Oj.
M. Signa: Saturated solution.

℞ Acidi salicylici, ʒss.
Boracis, gr. xx.
Aquæ, Oj. M.
(For ozæna.)

℞ Aluminis, ʒj.
Acidi carbolici, gr. viij.
Glycerini, ℥j.
Aquæ destillatæ, ℥vij.
M. Filter.

℞ Potassii chloratis, ʒj.
Extracti hamamelidis, ℥j.
Aquæ destillatæ, ℥v.
M. Filter.

℞ Tincturæ ferri chloridi,
Glycerini, of each, ℥j.
Aquæ destillatæ, ℥vj.
M. Filter.

℞ Sodii bicarbonatis, 1 per cent.
Aquæ, 99 per cent.
M. Signa: Use for boiling instruments (to prevent corrosion).

℞ Potassii chloratis, ʒj.
Aquæ cinnamomi, ℥viij.

℞ Potassii permanganatis, ʒij.
Aquæ, Oj.—M.

℞ Acidi carbolici, 5 per cent.
Aquæ, 95 per cent.
M. Solution for disinfecting instruments.

GARGLES.

℞ Boracis, ʒij.
Acidi carbolici, gr. xvj.
Glycerini, ʒij.
Aquæ rosæ, q. s. ad ℥viij.—M.

℞ Aluminis exsicc., ʒj.
Aquæ rosæ, ℥viij.—M.

℞ Aluminis,
Potassii bromidi, of each, 4 per cent.
Aquæ, 92 per cent.
M. Signa: Gargle.

℞ Potassii chloratis ʒiv.
Or
℞ Potassii bromidi, ʒiv.
Dissolve in a pint of pure water and gargle.

℞ Boracis,
Potassii chloratis, of each, ʒi
Potassii carbonatis, ʒvj.
Sodii chloridi, ℥ij.
Aquæ, q. s. ad Oj.—M.

SOLUTIONS FOR INJECTING INTO THE MIDDLE EAR THROUGH THE EUSTACHIAN TUBE.

Pilocarpine hydrochlorate, 2-per-cent. solution.

Six or 8 drops to be injected through the Eustachian catheter.

℞ Sodii bicarbonatis, gr. x.
Aquæ, ℥j.—M.

℞ Potassii iodidi, gr. v.
Aquæ, ℥j.—M.

℞ Camphor-mentholis, 3 per cent.
Lavolinis, 97 per cent.—M.

PIGMENTS.

Saturated solution of suprarenal gland.

℞ Acidi tannici, gr. x-xxx.
Acidi salicylici, gr. v.
Glycerini, ʒij.
Aquæ destillatæ, ʒvj.—M.

℞ Aluminis, gr. x.
Glycerini, ʒij.
Aquæ destillatæ, ʒvj.—M.

℞ Zinci sulphatis, gr. v.
Glycerini, ʒij.
Aquæ destillatæ, ʒvj.—M.

℞ Zinci chloridi, gr. x-l.
Glycerini,
Aquæ destillatæ, of each, ʒiv.—M.

℞ Cupri sulphatis, gr. x.
Glycerini, ʒij.
Aquæ destillatæ, ʒvj.—M.

℞ Iodoformi, ʒj.
Collodii, ʒx.—M.
(Iodoform-collodion.)
—KUSTER.

℞ Iodoformi, ʒj.
Ætheris, ℥j.—M.
(Iodoform-ether.)

℞ Iodoformi, gr. xxx.
Ætheris, ℥ss.
Aquæ destillatæ, q. s. ad ℥j.—M.
(Iodoform-ether.)
—NUSSBAUM.

℞ Glycerini acidi carbolici, ʒij.
Glycerini acidi tannici, ʒij.—M.

℞ Acidi carbolici, 12 per cent.
Glycerini, 88 per cent.—M.

Glycerinum acidum tannicum.

℞ Olei eucalypti,
Acidi carbolici, of each, ℥j.
Terebinthinæ, ℥viij.—M.

℞ Guaiacolis,
Glycerini, of each, ℥ss.—M.

℞ Morphiæ sulphatis, gr. iv.
Acidi carbolici, gr. xxx.
Glycerini, ℥j.—M.

℞ Morphiæ sulphatis, gr. iv.
Acidi carbolici,
Acidi tannici, of each, gr. xxx.
Glycerini, ℥j.—M.

℞ Argenti nitratis, gr. xl.
Aquæ, ℥j.—M.

℞ Argenti nitratis, gr. x.
Aquæ, ℥j.—M.

℞ Creasoti, 2 per cent.
Mentholis, 10 per cent.
Lavolinis, 88 per cent.
M. Signa: Apply to tubercular ulcers.

Lactic acid, applied to tubercular ulcers. At first it should be used in a solution of 20 to 40 per cent., gradually increasing to 100 per cent.

℞ Creasoti, gr. x.
Mentholis, ʒj.
Lavolinis, ℥j.
M. Signa: Apply to tuberculous ulcers.

Tincture of iodine.

℞ Plumbi acetatis, gr. v.
Aquæ, ℥j.
M. Signa: For syphilitic throat.

℞ Zinci chloridi, gr. xx.
Aquæ, ℥j.
M. Signa: For syphilitic throat.

℞ Cupri sulphatis, gr. xv.
Aquæ, ℥j.
M. Signa: For syphilitic throat.

Pyoktanin.

Sulphocalcin, either diluted or full strength, for dissolving false membranes.

℞ Potassii permanganatis, gr. xxx.
Aquæ, ℥j.—M.
(Antiseptic, and solvent of false membranes.)

℞ Acidi carbolici, gtt. xx.
Liquoris ferri subsulphatis, ʒiij.
Glycerini, ℥j.
Aquæ destillatæ, ℥ij.—M.
(Local application for diphtheria.)

Lactic acid, applied locally by inhalation or by a cotton swab. (A solvent of false membranes.)

℞ Alcoholis, 60 per cent.
Toluolis, 36 per cent.
Liquoris ferri chloridi, 4 per cent.—M.

(Löffler's formula for the local treatment of diphtheria. On account of the pain this solution produced, Löffler added to this 20 per cent. of menthol.)

Counter-irritants and Liniments.

Cantharidal collodion.

Essential oil of mustard.

Tincture of iodine.

℞ Linimenti saponis,
Linimenti camphoris compositi, of each, ℥j.—M.

℞ Linimenti belladonnæ,
Linimenti opii, of each, ʒiv.—M.

℞ Linimenti chloroformi,
Linimenti aconiti,
Linimenti belladonnæ,
Linimenti opii, of each, ʒiv.
Linimenti saponis, ℥j.—M.

℞ Tincturæ valerianæ, ʒij.
Ætheris sulphurici, ʒj.
Glycerini, ʒxij.—M.

℞ Olei tiglii,
Chloroformi, of each, ʒij.
Aquæ ammonii fortioris, ℥j.
Olei sesami, ℥iij.
M. Signa: Apply on cotton.

Ointments.

Vaselin, petrolatum, or petroleum ointment: the purified residue after distilling off the lighter and more volatile portions from American petroleum.

℞ Unguenti zinci oxidi benzoinati, ℥j.

℞ Hydrargyri oxidi flavi, gr. v.
Unguenti petrolei purificati, ℥j.—M.

℞ Unguenti acidi carbolici, ℥j.

℞ Unguenti acidi carbolici, ℥ss.
Unguenti zinci oxidi benzoinati, ℥iss.—M.

℞ Acidi salicylici, gr. xv.
Petrolati, ℥j.—M.

Epidermol.

Resinol.

Caustics.

℞ Acidi chromici,
Aquæ, of each, ʒj.—M.

Chromic acid fused into a bead (page 457).

Silver nitrate fused on a probe.

Glacial acetic acid.

Nitric acid.

Monochloracetic acid.

London paste.

Trichloracetic acid.

Electrocautery.

Powders. S

Aristol.

Nosophen.

Iodoform.

Boric acid.

℞ Bismuthi carbonatis, gr. ij.
Morphiæ, gr. $^{1}/_{2}$-$^{1}/_{6}$.
(For insufflation.)

℞ Sodii bicarbonatis,
Sodii boratis,
Amyli, of each, gr. iss.
Cocainæ hydrochloratis, gr. x.
Sacchari lactis, q. s. ad gr. c.—M.

℞ Morphiæ hydrochloratis, gr. ij.
Bismuthi subnitratis, ʒvj.
Pulveris acaciæ, ʒij.
M. Signa: "Ferrier's snuff," for cold in the head.

TABLETS.

℞ Ammonii chloridi, gr. j.
Tincturæ opii camphoratæ,
Syrupi scillæ compositi,
Syrupi Tolutani, of each, min. v.
Extracti glycyrrhizæ, gr. iij.
M. Signa: Throat-, or cough-, tablet.

℞ Morphiæ sulphatis, gr. $^{1}/_{12}$.
Atropiæ sulphatis, gr. $^{1}/_{600}$.
Caffeinæ, gr. $^{1}/_{8}$.
M. Signa: Coryza-tablet.

LOCAL ANÆSTHETICS.

Cocaine.

Eucaine.

℞ Acidi carbolici, 12 per cent.
Glycerini, 88 per cent.—M.

GENERAL ANÆSTHETICS.

Ether.

Chloroform.

Ethyl-bromide: hydrobromic ether.

GENERAL REMEDIES.

Sodium bromide in doses of 30 or 60 grains in large amount of water, especially at bedtime.

℞ Zinci valerianatis, gr. ij.
Extracti nucis vomicæ, gr. $^{1}/_{4}$.
Extracti gentianæ, gr. ij.
M. Fiat pilula.
Signa: One pill thrice daily.

℞ Ammonii chloridi, ʒj.
Tincturæ opii camphoratæ,
Syrupi scillæ compositi,
Syrupi Tolutani,
Syrupi glycyrrhizæ, of each, ℥j.
M. Signa: Teaspoonful every two or four hours. (Cough-syrup.)

℞ Calcii sulphidi, gr. iij.
Fiat in pilulas No. xij.
Signa: One three times a day for suppuration.

Acidi arseniosi, gr. $^{1}/_{30}$ thrice daily for furunculosis and herpes.

℞ Tincturæ ferri chloridi, ʒij.
Glycerini, ℥j.
Aquæ, ℥iij.—M.

℞ Ferri reducti,
Quiniæ sulphatis, of each, gr. j.
Strychniæ sulphatis, gr. $^{1}/_{60}$.
M. Fiat in pilulam No. j.
This pill may be taken two or three times a day, after meals.

℞ Tincturæ ferri chloridi, ʒj.
Glycerini,
Aquæ, of each, ℥j.—M.
(Billington's formula.)

℞ Hydrargyri chloridi mitis,
Sodii bicarbonatis, of each, gr. j.—M.

℞ Hydrargyri chloridi corrosivi, gr. $^{1}/_{100}$-$^{1}/_{50}$.
Sacchari albi, gr. iii-v.
M. Triturate; fiat in chartulam No. j.
Signa: Apply dry on the tongue every hour. (For diphtheria or croup.)

Remedies for Tinnitus Aurium.

℞ Acidi hydrobromici diluti, ℥j.
Aquæ, ℥iij.

M. Signa: A teaspoonful well diluted three times a day.

Fluid extract of cimicifuga racemosa, in 30-drop doses daily.

Febrifuges.

Antipyrin.

Phenacetin.

Acetanilid.

Sedatives.

Exalgin.

Potassium bromide.

℞ Bromidiæ, ℥ij.

Signa: One-half teaspoonful in water every half-hour until pain is relieved.

Aconite.

℞ Tincturæ aconiti, ʒss.
Potassii bromidi, ʒiss.
Aquæ, ℥ij.

M. Signa: Teaspoonful every hour in tonsillitis.

Emetics.

Apomorphine.

Hydrargyri subsulphas flavus (turpeth mineral).

Powdered alum.

Ipecac.

Sulphate of copper.

Remedies for Rheumatic and Gouty Affections.

Salicin.

Salicylic acid.

Salol.

℞ Acidi salicylici, ʒiij.
Sodii bicarbonatis, ʒij.
Elixiris gaultheriæ, ℥ss.
Glycerini, ʒiij.
Aquæ, q. s. ad ℥iv.—M.

Lithium carbonate or citrate.

Alkalithia.

Citrate of lithia, soda, and potash (effervescent).

Sodium phosphate (alkaline laxative and cholagogue).

Remedies for Tuberculosis.

Codliver-oil and maltine.

℞ Vini ferri citratis, ℥iv.

Signa: Dessertspoonful after each meal.

℞ Syrupi hypophosphitis compositi (Fellows's), Oj.

Signa: A teaspoonful three times a day after meals.

℞ Olei morrhuæ, Oj.

Signa: A teaspoonful thrice daily, after meals, in lemon-juice or coffee; or inunction twice daily, rubbing a tablespoonful into the skin of the abdomen, and covering with oiled silk or flannel.

Guaiacol in doses of 1 to 10 minims after each meal, given in glycerin, milk-broths, or wine.

Creasote, 1 to 10 minims or more three times a day, given in milk, alcoholic or tonic preparations, or in capsules.

Remedies for Syphilis.

℞ Hydrargyri bichloridi, gr. j.
Potassii iodidi, ℥ss.
Syrupi sarsaparillæ, ℥iv.—M.

℞ Syrupi ferri iodidi, ʒiv.
Glycerini, ℥iss.
Aquæ, ℥iv.

M. Signa: Teaspoonful three times a day.

℞ Sodii iodidi, ℥ss.
Essentiæ pepsinæ (Fairchild),
Syrupi zingiberis, of each, ℥iij.

M. Signa: Drachm j ter die.

Pilocarpine-hydrochlorate solution, 2 per cent. Ten or 15 drops to be injected under the skin. (For labyrinthal disease, syphilitic.)

℞ Potassii iodidi, gr. viij.
Ferri et ammonii citratis, gr. xxiv.
Elixiris aurantii,
Aquæ, of each, ℥ij.

M. Signa: Drachm j or ij thrice daily. (For children.)

℞ Potassii iodidi, ʒiv.
Ammonii carbonatis, ʒj.
Elixiris simplicis, ℥j.
Infusionis calumbæ, ℥v.

M. Signa: Tablespoonful in water three times daily. (For syphilis and caries.)

℞ Potassii iodidi, ʒj.
Ferri et ammonii citratis, ʒij.
Infusionis calumbæ, q. s. ad ℥vj.

M. Signa: Tablespoonful in water thrice daily.

Miscellaneous.

Nitrite of amyl; used for inhalation in hay fever, asthma, and collapse from anæsthetics. Dose, 10 or 20 drops.

Pure camphor-menthol inhaled from a bottle or glass tube, for hay fever and cold in the head.

INDEX.

Abbott, 171
Abel, 73
Abscess, cerebral and cerebellar, 474
  extradural, 473
  metastatic, 474
  of brain, 474
  of larynx, 290, 291
  of neck, 241, 512
  of nose, 97
  retropharyngeal, 240, Plate IV
  subdural, 473
  tonsillar, 198, 201
Accessory cavities of the nose, diseases of, 104
Accidents in operations, 143, 231
Acoumeter, 350
Acute otitis externa, 387
Acute otitis media, 402
  appearances of membrana tympani, 403, Plate VIII
  grip as a cause, 19, 20
  leech, artificial, 405
  leeches, 405
  naso-pharynx, 128, 134, 136
  paracentesis membranæ tympani, 406
  relief of pain, 404
  treatment, 404
Acute purulent otitis media, 407
  grip as a cause, 19, 20
  influenza as a cause, 19, 20
  membrana tympani, appearance of, 408, 410, 411, Plate VIII
  micro-organisms, 407
  treatment, 408
Acute rhinitis, 21
Adenoid hypertrophy of vault of pharynx, 134
  ear complications, 134, 136
  eye complications, 119
Adjustable light, 2, 3, 340
Age, influence of, in diseases, 162, 331
Agnew, 515
Air, compressed, and apparatus, 356-370
Air-pressure, 357
Alderton, H. A., 530
Alkaline sprays, Appendix
Alt, 121
Amaurosis, 69, 121
Amberg, E., 497
Amblyopia from nasal disease, 121, 122
Amygdalitis, 198
Anæmia of the labyrinth, 514
Anæsthesia, bromide of ethyl, 137-143
  local, in nasal surgery, 66
  of pharynx, 243
Anæsthetics, general, 439
Andrews, A. H., 9, 497
Angina catarrhalis acuta, 147
  Ludwig's, 204
  rheumatic, 154, 156
  scarlatinous, 160
  tonsillaris, 198
Angioma of pharynx, 238
Ankylosis of the ossicles, 419
Anomalies of auricle, 380-383
  of external meatus auditorius, 382, 383
  of pharynx, 229
  of sensation in larynx, 297
  of uvula, 217
Anosmia, 92
Antiseptic sprays, Appendix
Antrum, aditus ad, Figs. 220, 221
  irrigator, 109
  mastoid, Figs. 220, 221
  maxillary, 104
  of Highmore, 104, 109
Aphonia, 299
Applicator, caustic, 458
Aquæductus Fallopii, Figs. 209, 210, 220, 221
Arnold, J. D., 265
Arrangement of instruments and apparatus, Fig. 1
Arslan, 134, 527
Artificial drumheads, 461
Asch, Morris J., 95
Aspergillus of the ear, 390
Aspirator for the ear, 454
Asthenopia from nasal disease, 81, 118, 120, 121, 122
Asthma, 29, 30, 31, 35, 37, 39, 41, 44, 45, 82, 95, 121
  from nasal disease, 31, 39, 51, 59
Astigmatism from nasal disease, 121

Asymmetry of nasal bones, 57, 93
Atmospheric causes of disease, 18, 19, 24, 34, 42, 43, 46, 126, 129, 147, 205, 263, 268, 284, 293, 334, 391, 520
Atomizers, 8, 9, 10
Atresia of external auditory meatus, 392
  nasal, 101
Atrophic catarrh of naso-pharynx, 130
  rhinitis, 73
Audiphone, 531
Auditory canal, 384
  acute inflammation, 387
  boils of, 388
  bony growths, 392
  cerumen, 384
  chronic inflammation, 387
  exostoses, 392
  foreign bodies, 393
  furuncles 388
  hyperostosis, 392
  imperforate, 392
  malignant disease, 376, 378
  narrowing, 392
  neoplastic closure, 392
  parasitic inflammation, 390
  sequestra, 468, 471
Auditory nerve, 518-523
Aural fungi, 390
  vertigo, 385, 388, 400
Auricle, benign tumors of, 379
  carcinoma, 378
  cutaneous diseases, 375
  cystoma, 379
  deformities, 380-383
  eczema, 375
  frost-bite, 375
  gangrene, 377
  hæmatoma, 379
  herpes, 380
  hypertrophy, 380
  inflammatory affections, 375-380
  intertrigo, 380
  lupus, 376
  malignant disease, 378
  othæmatoma, 379
  pemphigus, 380
  perichondritis, 378
  scroll-deformity, 382
  syphilis, 380
  wounds and injuries, 383
Auscultation-tube and method of using, 373, 374
Autoaspiration, 417
Autoinflation of the middle ear, 360, 416, 430
Automatic tuning-fork, 347
Autophony, 385, 402
Autoscopy, 257

Bacon, G., 396
Bag, ice-, 483
Baginsky, 170
Baker, A. R., 485
Baldness not a cause of disease, 335
Ballinger, W. L., 23
Bandage, net, 500
Barclay, Robert, 443
Barr, Thomas, 390
Bartley, 36
Baum, W. L., 196
Baurowicz, 73
Bean, C. E., 202
Behrens, B. M., 438
Behring, 187, 188
Bell, A. G., 532
Berens, B., 27
Bergmann, 474
Bertillon, 38
Bezold, 407, 462
Bifid uvula, 217
Bing's hearing-test, 350
Bischoff, 300
Bishop, D. D., 196
Bishop, S. S., 123
Black, G. M., 71
Blake, Clarence J., 437, 443, 444
Bleeding, local, in acute otitis media, 405
Blennorrhœa, 24
Blepharitis, 118, 119
Blepharospasm, 121
Blindness from sphenoid disease, 112
Blitz catarrh, 17
Boils in the external ear, 388
Bone, turbinated, inferior, Plates I, II, III, IV
    middle, Plates I, II, III, IV
    superior, Plates I, II, III, IV
Bone-conduction, 346, 348
  in chronic aural catarrh, 422
Bostock, John, 30
Bosworth, Francke H., 5, 55, 284, 320
Bouchard, 36
Bouchut, 273
Bougies, Eustachian, 401
  nasal, 26
Boxing the ears, 379, 396
Bracket, adjustable lamp-, 340
Brain-abscess, 474
Braun, 75
Breathing, mouth-, 58, 135, 284
Brennecke, H. A., 196
Bresgen, 118, 120
Broadbent, 39
Bromide of ethyl, 137-143
Brown, Dillon, 272
Brown, J. Price-, 96, 213, 307
Brown, Moreau R., 55
Browne, J. Lennox, 152, 182, 201, 220 288, 306, 315, 320, 324, 325

Brown-Séquard, on hæmatoma, 379
Bryant, W. S., 449
Buck, A. H., 369, 394, 518
Burnett, Charles H., 49, 391, 437, 443
Burns and scalds of the pharynx, 245

Caisson, effect on ear, 396
Calcareous degeneration of the middle ear, 418, 419, Plate VIII
Calculi, nasal, 82
  tonsillar, 215
Camphor-menthol, 13
  inhaler, 15
Canal, external auditory, 384
  Fallopian, Figs. 170, 220, 221
  glands of external meatus, Fig. 170
  imperforate, 392
  section of, Fig. 170
Canalis tensoris tympani, 399
Cancer of pharynx, 235
Carcinoma, of ear, 378
  larynx, 320
  nose, 85
  pharynx, 235
Caries and necrosis from middle-ear diseases, 449, 457, 467
Carious teeth, 104, 214
Carotid artery, rupture of, in suppuration of middle ear, 469
  canal, 499, 500
Cary, Frank, 278
Case-records, 352-355
Casselberry, William E., 54, 80
Catarrh, chronic, of middle ear, 412, 418
  exudative, 412
  heredity of, 420
  hypertrophic, of the nose, 57
  nasal, 21
  nervous, 29
  of the middle ear, sero-mucous, 412
  purulent, 24
Catarrhal fever, 17
  otitis media, acute, 402
Catheter, Eustachian, 372
  in chronic aural catarrh, 416, 429, 430
  method of using, 369
Causes of disease, atmospheric, 18, 19, 24, 34, 42, 43, 46, 126, 129, 147, 205, 263, 268, 284, 293, 334, 391, 520
Caustic applicator, 458
  chemical, 457
  for nose and throat, 60
Cauterization, electric, 67, 68
Cautery, electric, 60-68
Cavities, accessory, of nose, 104
Cerebellar abscess, 474
Cerebral abscess, 474
Cerebral causes of deafness, 523
Cerebro-spinal rhinorrhœa, 27
Cerumen, impacted and inspissated, 384
Chapman, J., 55
Charcot, 522
Cheatham, William, 55, 123
Chiari, 75, 323, 325
Cholesteatoma of mastoid, 462
  of middle ear, 462
  of tonsils, 214, 215
  Stacke's operation 504
Chondromata, nasal, 81
Chorda tympani nerve, 435, Fig. 165
Chorditis tuberosa, 292
Chorea of pharynx, 244
Chrobak, 72
Chronic catarrh of the middle ear, 412, 418
    adhesive inflammation, 418
    age, 420
    alcohol, effects of. 420, 421
    ankylosis of ossicles, 419
    atrophic stage, 418
    auditory hallucinations, 520
    autoaspiration in, 416, 417
    autophony, 415
    calcareous degeneration, 418, 419
    climatic conditions, 415, 421, 520
    deafness, 422
    differential diagnosis, 415, 423
    electricity, 432
    Eustachian catheter, 372, 417, 429, 430
      tube, 59, 399, Plate I
    excision of membrana tympani and ossicula, 437, 439
    exudation, 412
    foreshortening of handle of mallet, 413, Plate VIII
    frequency of, 332, 333
    heredity, 420
    hygienic surroundings, 334
    hyperæmia, 412
    hypertrophic, 412
    injection of liquids, 429
      vapors, 429
    loud noises, effects of, 421, 422
    mobilization of stirrup, 443
    ossicles in, 419
    otalgia, 414, 421
    pain in ear, 414
    paracentesis, 406
    paracusis, 423
    partial excision of membrana tympani, 436
    peculiar modifications of hearing, 414, 415
    pneumatic tests, 414
    proliferation, 418

Chronic catarrh of the middle ear, removal of membrana tympani and ossicles, 437, 439
    stapes, 440, 442, 444
  retraction of membrana tympani, 413, Plate VIII
  sclerosis, 418
  secretive, 412
  sensations of discomfort, 414, 415
  statistics, 331-336
  tenotomy of tensor tympani, 437
  tinnitus aurium, 415, 421, 519
  tobacco, effects, 420
  uric acid, 419
  vertigo, 415, 422
 purulent otitis media, 445
  antiseptic powders, 451
    solutions, 450, Appendix
  appearances of membrana tympani, 445, Plate VIII
  caries and necrosis of adjacent tissues, 449, 457, 467
    of ossicles, 446, 459
  caries of carotid canal, 469
  cause of intracranial lesions, 450, 469
  cerebral abscess from, 450, 469
  cholesteatoma, 462
  deafness following suppuration, 461
  excision of drumhead and ossicles, 443
  exfoliation of cochlea, 467
  facial paresis and paralysis, 463
  granulations, 448, 456
  labyrinthal invasion, 449
  mastoid complications, 448, 450
  meningitis, 450, 472
  metastasis, 474
  paralysis and paresis, facial, 463
  perforation of the membrana flaccida, 446
  perforations of the drumhead, 460
  phlebitis of lateral sinus and jugular vein, 450, 469, 477
  polypi, 449, 456
  pyæmia, 450, 469
  rupture of carotid artery, 469
  seat of intracranial lesions, 450
  sequelæ, 456-479
  sequestra, 468, 471
  symptoms, 448
    of brain-abscess, 474
    of sinus-thrombosis, 477
  thrombosis of lateral sinus and jugular veins, 450, 477
  treatment, 450
 suppurative tympanitis, 445
Chronicity of diseases, 335
Circumscribed otitis externa, 388
Cirrhotic rhinitis, 73
Clark, Sir Andrew, 56
Classification of diseases, 331-336
  of occupation, sex, etc., 331-336
Cleft palate, 218, 383
Clergyman's sore throat, 161
Climatic influences, 18, 19, 24, 34, 42, 43, 46, 126, 129, 147, 205, 266, 268, 284, 293, 334, 391, 520
Cline, L. C., 106
Clinical records, 352-355
Clothing, 24, 130, 272
Coakley, C. G., 95, 213
Cocaine, 26, 231
Cocainization, 66, 231
Cochlea, 470
  exfoliation, 467
Cohen, J. Solis-, 55, 163, 222, 288
Cold, catching, 22, 147, 261, 268
Cold in the head, 21
Coleman, W. F., 118
Colles, C. G., 419
Comparison of statistics, 336
Compressed air, 356-374
  apparatus, 356-370
  meters, 357, 364, 369, 370, Fig. 1
Concretions of drumhead, 418, Plate VIII
  tonsils, 215
Congenital deafness, 526
  deformities of nose, 101
Conjunctivitis from nasal disease, 117, 118, 119, 120
Conklin, 37
Coppez, 120
Corbin, 272
Corneal inflammation from nasal disease, 120
Coryza, 21
  tablets, 21
Cotton, A. C., 196
Cotton-carriers, 288, 289, 343
Cough-tablets, 151
Coulter, J. H., 409
Cozzolino, 444
Croup, 267
  intubation, 273
  laryngismus stridulus, 296
  membranous, idiopathic, 267
  spasm of the glottis, 296
  spasmodic, 296
  spurious, 261
  tracheotomy, 279
    choice of operation, 280
  treatment, 271
Cruveilhier, 238
Crypts of tonsils, 198, 204, 215
Curettes, 488
Curtis, H. H., 52, 55
Cut-off, compressed air, 358
Cutter, Ephraim, 318

Cystoma of auricle, 379
  larynx, 313
  pharynx, 235

Dabney, Samuel G., 119
Dacryocystitis from nasal disease, 118, 120
Dalby, W. B., 393
Daly, W. H., 55
Darwin, 42
Davey, James R., 469
Davis, Nathan Smith, 37, 50
De Lamalleree, 56
De Schweinitz, 117
De Vilbiss, Allen, 251
Deaf-mutism, 134, 526
Deafness, causes of, 400, 403, 415, 421, 448, 515, 516, 517, 518, 522, 523, 524, 525, 526
  congenital, 526
  following suppuration of middle ear, 461
  hereditary, 527
  hysterical, 522
Deflections of septum nasi, 93
Deformities of auricle, 380 383
  nose, 93, 101
Delavan, D. B., 99, 141, 214
Delstanche, Charles, 417, 428, 451
Dench, Edward B., 464
Desiré, 307
D'Espine, 170
Dieffenbach, 133
Diet, 50, 130, 152
Dilatation of pharynx, 232
Dilators for nose, 26
Dionisio, 75
Diphtheria, 167
  age of patients, 170
  bacillus, 167, 168
  diagnosis, 175
  diphtheric exudate, 167
  diphtheroid, 174, 175
  effect on ear, 174, 176
    eye, 120, 174
  false, 167, 169
  incubative period, 171
  intubation, 273
  microbe, 167, 168, 175
  of the nose and naso-pharynx, 174, 176, 184
  paralysis, 174, 185
  propagation, 172
  prophylaxis, 178, 188
  pseudodiphtheria, 167, 169
  sequels, 185
  symptoms, 172
  treatment, 177
    antitoxin, 187
    hygienic, 178, 179, 180
Diphtheria, treatment, internal, 185
    local, 181
    serum-therapy, 187
    tracheotomy, 279
    vitality of Klebs-Löffler bacillus, 170
Diphtheroid, 174, 175
Direct laryngoscopy, 257
Disinfection, 66, 136, 177-180
Diverticulum, 232
Dobell's solution, 16
Dodd, Oscar, 112
Double hearing, 519
  retractors, 490
  uvula, 217
Douche, nasal, 9
Douglas, O. B., 94
Drumhead. See Membrana tympani.
Ducts emptying into nasal meatuses, 111, 117, 119
Duel, A. B., 401
Dunbar, 52
Dunn, J., 119
Dynamomotor, 65
Dysphonia, 313

Ear disease, brain-abscess, 474
  from diphtheria, 174, 176
  from disorders of nervous system, 518, 523
  from exanthemata, 159, 160
  from grip, 19, 20
  from influenza, 19, 20
  from intracranial growths, 524
  from leucocythæmia, 517
  from meningitis, 523
  from nasal disease, 59, 128
  from pharyngeal disease, 128, 136, 148, 152, 163, 236
  from syphilis, 517
  from tonsillitis, 199
Ear, electrodes, 432, Fig. 188
  internal, 514
  malformations, 380, 382
  middle, 396, Figs. 220, 221
  noises, subjective, 385, 391, 398, 400, 403
  relation of nose to, 398
  specula, 341
Ear-cough, 385
Ear- fungi, or mold, 390
Ebstein, 37
Ecchondrosis, nasal cavities, 81
Eczema of auricle, 375
  eyelid and face, 118
Ehrlich, 187
Electric-current transformer, 65, 66
Electric motor, 65
Electric trephines, 70
Electricity in various diseases, 60, 93, 432

- Electrode, laryngeal, 321
- Electrodes, ear-, 432, Fig. 188
  - nasal, 64, 67
- Emphysema from inflation of nose, 116
- Empyema of antrum of Highmore, 104
  - of frontal sinuses, 112
  - of maxillary sinuses, 104
- Enslee, Charles L., 331
- Epidemic catarrh, 17
- Epiglottis retractor, 255
- Epiphora from nasal disease, 118
- Epistaxis, 76
  - plugging nares, 77
- Epithelioma of ear, 378
  - of larynx, 320
  - of nose, 85
  - of pharynx, 235
- Epizootic, 17
- Erectile tumors of nasal cavities, 80
- Ethmoid sinuses, diseases of, 109
  - osteoma, 110
  - polypi, 109, 110
- Etiology of diseases, 331-337
- Eustachian catheter, 372, 417, 429, 430
    - emphysema from use of, 373, 374
    - method of using, 369
  - salpingitis, 398
  - tube, 59, 399, Plate I
    - canalis tensoris tympani, 399
    - cartilage of, 399
    - constriction of, 398
    - fossa of Rosenmüller, 372
    - isthmus, 399
    - membranous part, 399
    - orifice, 372, 399
    - patency, 398
    - stenosis, 398, 401
- Euthanasia, 324
- Examination of patients, 3, 251, 338
- Exanthemata, effect on ear, 335
  - effect on nose, 21
  - effect on pharynx, 159, 160, 161, 240
- Excision of membrana tympani and ossicula, 437, 439
  - partial, of membrana tympani, 436
- Exophthalmic goitre, 121
- Exostoses of auditory canal, 392
  - of nasal cavities, 70, 81
- External ear, 375
  - auricle, 375
- Extradural abscess, 473
- Exudative catarrh of middle ear, 412
  - sore throat, 161
- Eye diseases from diseases of the nose, 116
- Eyestrain, 123

- Facial expression in diseases of the nose and throat, 135, 137
- Facial paralysis, 463
- Faith, Thomas, 374
- Fallopian canal, Figs. 170, 220, 221
- False diphtheria, 167, 169, 174, 175
  - hearing, 519
- Farcy, 90
- Fatality of chronic suppuration of the middle ear, 445, 468, 469, 472, 474, 477, 482, 483
- Fenestra ovalis, Fig. 218
  - rotunda, Figs. 174, 175
- Fenger, Christian, 27
- Fessler, 138
- Fetid catarrh, 73
- Fibroma of larynx, 313
  - of nasal cavities, 79, 131
  - of pharynx, 238
- Fick, 147
- Fischer, 120
- Fliess, 72
- Floor of the tympanum, Fig. 170
- Folds of membrana tympani, Fig. 118
- Follicular pharyngitis, 161
- Foreign bodies in ear, 393
  - in larynx, 326
  - in nose, 101
  - in pharynx, 245
- Fork, automatic tuning-, 347
- Fossa of Rosenmüller, Fig. 136, Plate VIII
- Fournier, 225
- Fourth tonsil, 212
- Fracture of base of skull, 525
  - of nose, 100
- Fränkel, 318
- Frankenberg, 134, 527
- French, J. M., 100
- Frequency of disease, relative, 332-336
- Frontal sinuses, diseases of, 112, 115
  - transillumination, 114
- Frost-bite of auricle, 375
- Fruitnight, 272
- Fungi, aural, 390
- Funk, 120
- Furuncles of ear, 388
  - of nose, 91

- Galezowski, 123
- Galton's whistle, 350
- Galvanocautery, 60, 67, 68
- Ganglion, sphenopalatine, 31
- Gangrene of the ear, 377
- Garcia, 260
- Garlick, H. S., 143
- Gellé, 444
- Gellé's hearing-test, 350
- General considerations, 331
- Generative organs and the voice, 300
- Genital spots of nose, 72
- Gersuny, 101

Glanders, 90
Glasgow, W. C., 54, 222, 271
Glaucoma, 120, 121
Gleason, 96, 443, 454
Gleitsmann, J. W., 94
Glenoid fossa, Fig. 211
Globus hystericus, 213, 244, 247, 298
Glottis, spasm of, 296
Gluck, I., 56
Goldstein, M. A , 103, 467, 530
Gonorrhœa, nasal, eye symptoms, 120
Gottstein, 139, 271
Gouges, 487
Gouguenheim, 56, 202
Gould, G. M., 118
Gout, a cause of hay fever, 36, 48
  effect on the ear, 419
    nose, 23
Gouty sore throat, 154, 156
Grant, J. Dundas, 271, 315, 429
Granular pharyngitis, 161
Granulations in suppuration of the middle ear, 448, 456
  of vocal cords, 292
Gray, L. C., 40
Greene, J. O., 437
Grip, 17
  cause of otitis media, 19, 20
  effect on ear, 19, 20
Gruber, Josef, 356, 516
Gruhn, 118
Guenod, 120
Gummata of larynx, 324
  of pharynx, 223
Gunn, Moses, 107
Guttmann, 120, 185
Guye, 522

Habermann, J., 419, 462
Hack, 121
Hæmatoma of auricle, 379
  of nose, 97
Hæmorrhage from adenoid operation, 140, 141
  from varicose veins, 213
  nasal, 76
  of internal ear, 516
  operative, 232
  pharyngeal, 239
Haig, Alexander, 36-39
Hajek, 73, 323
Hall, Marshall, 296
Hallucinations, auditory, 520
Hamilton, T. K., 119
Hanau, 204
Hansell, 121
Hardie, T. Melville, 55, 142
Hartman, A., 360
Hartmann's inflation experiments, 360
  tuning-forks, 347, 348
Hasse, 237
Hay asthma, 29
Hay fever, 29
  antitoxin, 52
  etiology, 34, 42
  gout, 36, 48
  medical opinions, 53
  nasal disease in, 31, 33
  neurosis, 29
  organic disease, 30, 31, 33, 34, 51
  pathology, 29
  symptomatology, 44
  treatment, 46
  uric acid, 36
Head-mirror, 339
Hearing, double and false, 519
  instruments, 531
  tests of, 346-353
Heitzman, 36
Hektoen, Ludwig, 27
Henoch, 170
Hereditary deafness, 420, 527
Heredity, 41, 42, 87, 88, 148, 218, 305, 321, 527
Herpes of auricle, 380
Herpetic pharyngitis, 164
Heryng, 114, 221, 320
Highmore, antrum of, 104
Holmes, C. R., 143
Hooks, double mastoid, 490
Hooper, 141
Horsley, 475
Hotz, F. C., 402, 454
Hubbard, Thomas, 237
Hutchinson, 517
Hydrorrhœa, 25, 27, 44
Hyperæmia of the labyrinth, 514
Hyperæsthesia acoustica, 519
Hyperæsthesia of larynx, 297
  of nose, 32, 34, 35
  of pharynx, 242
Hyperaudition, 518
Hyperostosis in auditory canal, 392
Hyperplasia, nasal cavities, 57
Hypertrophic sore throat, 161
Hypertrophies, nasal cavities, 57
  posterior, surgery of, 136
  tonsillar, 204
Hypertrophy of auricle, 380
  of tonsils, 204
Hysterical deafness, 522
  aphonia, 299, 302

Icebag, 483
Illumination, 3, 4, 251, 339
Imperforate external meatus, 392
Incision of membrana tympani, 406
  over mastoid process, 485
Incus, Figs. 165, 170, 189, 220, 221
  articulation, Figs. 165, 170, 192

Inflation of tympana, 368-373
  Politzer's method, 368
  Valsalva's method, 360, 416, 430
Inflators, 370, 371
Influence of age on diseases, 162, 331
  of occupation, 331
  of sex, 331
Influenza, 17
  cause of otitis media, 19, 20
  effect on ear, 19, 20
Ingals, E. Fletcher, 165, 221
Inhalents, 12-16
Inhalers, 15
Instruments, ear, 338-351
  hearing-, 531
  mastoid, 486-490
  nasal, 4-12
Insufflators, Figs. 83, 144, 178
Insurance, life-, 533
Internal ear, 514
  anæmia, 514
  aural vertigo, 385, 388, 400, 415, 422, 449, 467, 473, 474, 514, 515, 516, 517, 524, 525
  concussion of labyrinth, 525
  fracture at base of skull, 525
  hæmorrhage, 516
  hyperæmia, 514
  hyperæsthesia acoustica, 519
  hysterical deafness, 522
  leucocythæmic deafness, 517
  Ménière's disease, 516
  new growths, 524
  panotitis, 515
  primary acute labyrinthitis, 514
  suppurative exfoliation, 467
  syphilis, 517
Intertrigo of auricle, 380
Intubation of larynx, 273
Iritis from nasal disease, 120, 121
Irrigator, antrum, 109

Jack, Frederick L., 437, 443, 476
Jackson, 517
Jackson, A. Reeves, 40
Jarvis, 69, 315
Jewell, J. S., 47
Joal, 42
Jones, 455
Jones, Bence, 47
Jugular fossa, Figs. 170, 213
  vein, phlebitis of, 450, 477
    thrombosis of, 477

Kayser, 213
Keratitis from nasal disease, 118, 120
Kinnear, B. O., 55
Kirstein, A., 257
Kitasato, 187, 189
Kitchen, 55, 202
Klebs, Edwin Theodore, 167, 190, 191
Knapp, H., 120, 476, 523
Knife in septum deformities, 70
Knight, C. H., 54, 75, 140
Knight, F. I., 292
Koch, 189, 307
Kocher, 133
König, 133
Körner, 475
Kossel, 189
Kramer, 527
Krause, 221, 325
Krückmann, 204
Kuh, Edwin J., 55
Küster, 476

Labyrinth, concussion, 525
  diseases of, 514
  injuries, 525
Labyrinthitis, primary acute, 514
Lacrymal canal, affection of, from nasal disease, 117, 118, 120
Lacrymation from nasal disease, 117, 118, 120, 121, 123
Lacunæ of tonsils, 198, 214
Laker, 75
Lange, 50
Langenbeck, 133
Langerhans, 190, 191
Laryngeal forceps, 315, 319
  paralysis, 301
  spasm, 296
Laryngismus stridulus, 270, 291, 296
Laryngitis, acute, 261
    symptoms, 262
    treatment, 264
  atrophic, 290
  catarrhal, 261
  chronic, 283
    treatment, 288
  œdematous, 263, 292
  phlegmonous, 290
  purulent, 290, 292
  rheumatic, 266
  simple, 261
  spasmodic, 263
  stridulous, 263
  suppurative, 290
  syphilitic, 308
  tubercular, 304
Laryngoscope, 251
Laryngoscopic image, Plate IV
Laryngoscopy, difficulties of, 254
  direct, 257
  indirect, 251
Larynx, abscess of, 290
  acute catarrh of, 261
  anatomy of, Plate V
  anomalies of sensation, 297
  cancer, 320

- Larynx, chronic catarrh of, 283
  - deformities, 310
  - examination, 251-260
  - foreign bodies in, 326
    - treatment, 326
      - laryngotomy, 318
      - tracheotomy, 279
  - growths in, 312, 320
    - carcinomata, 320
    - chondrosarcoma, 326
    - cystomata, 313
    - epitheliomata, 320
    - fibromata, 313
    - mucous polypi, 313
    - myxomata, 313
    - pachydermia, 318
    - papillomata, 312
    - polypi, 313
    - sarcomata, 325
    - singer's nodule, 319
  - hæmorrhages, 310
  - intubation of, 273
  - neuroses of, 296
    - aphonia, 299
    - hyperæsthesia, 297
    - neuralgia, 297
    - paræsthesia, 297
    - paralysis, 301
    - spasm of glottis, 296
  - œdema of, 263, 292, 326
  - stenosis, 293, 305, 308, 310, 311
  - syphilis, 308
  - tuberculosis, 304
  - tumors, 312
  - vocal bands, Plate IV
- Lateral sinus, Figs. 190, 193, 209, 212, 213, 214, 222
  - phlebitis of, 450, 469, 477
  - thrombosis of, 477
- Laurens, 121
- Lavolin, 13
- Lederman, M. D., 479, 485
- Leeches, 405
- Lees, D. B., 56
- Lefferts, 326
- Leflaive, 37
- Leiter's coil, 202
- Leland, G. A., 414
- Leonard, C. H., 300
- Leukæmia, effect on ear, 517
- Lever, 36
- Levy, Robert, 69, 213, 222
- Life-insurance, 533
- Light for examination, 3, 251, 339
- Light-condenser, 339
- Lincoln, R. P., 161
- Linea temporalis, Fig. 211
- Lingual tonsil, 212
- Linhart, C. P., 27
- Loewenberg, 73, 336
- Löffler, 167, 184
- Love, I. N., 185
- Lucæ, 428, 462
- Ludwig's angina, 204
- Lupus of the ear, 376
  - of the nose, 90
- Luschka, tonsil of, 134
- Lymphangioma, 238
- Lymphosarcoma of pharynx, 239

- MacCoy, Alexander W., 241
- Macewen, 475
- Mackenzie, John Noland, 55
- Mackenzie, Sir Morell, 206, 228, 267, 300, 324
- Maggots in the nose, 103
- Malformations of the ear, 380, 382
- Malignant disease from suppuration of the middle ear, 376, 378
- Malignant neoplasms in larynx, 320
  - in the nasal cavities, 84, 85
  - in the naso-pharynx, 134
- Malleus, Figs. 147, 165, 170, 189, 220, 221
  - fracture of, 433
  - ligaments, Fig. 147
- Marckwort, 124
- Marey's law, 38
- Martin, 187
- Massage otoscope, 342, 426
  - of external meatus, 431
  - of nose, 74
  - treatment of ear, 343, 426, 427
  - vibratory, 74
- Mastoid antrum, Figs. 220, 221
  - cells, Figs. 220, 221
  - curettes, 488
  - disease in otitis media, 479
  - guide, 489
  - hooks, 490
  - inflammation, 479
    - cholesteatoma, 462
    - complications of, 479
    - instruments for operation, 486-491
    - operative treatment, 485, 486
    - primary, 479
    - sclerosis, 481
  - operations, 492-512
    - hæmorrhage in, 490, 493, 496
  - portion, temporal bone, Figs. 220, 221
- Maxillary antrum or sinus, 104
- Mayer, E., 96
- Mays, Thomas J., 37
- McBride, P., 56, 455
- Measles, sore throat, 159
- Meatus, external auditory, 384
  - internal auditory, Figs. 193, 208, 219

Membrana flaccida, Fig. 118, Plate VIII
Membrana tympani, 344, 345, Plate VIII
  atrophy of, 413, 418
  chorda tympani, 435, Fig. 165
  excision of, 437, 439
  folds, Fig. 118
  granulations, 448, 456
  hæmorrhage, 396
  hyperæmia, 396
  inflammation, 396
    adhesions, 419, 423, 459, 461
  injuries, 396
  inspection, 344
  massage of, 343, 426
  membrana flaccida, Fig. 118
    propria, Fig. 118
  normal, 344, 345
  paracentesis of, 406
  perforations, 460
  pockets, or pouches, Fig. 147
  polypi, 449, 456
  position of ruptures, 446
  Prussak's fibres, 345
    space, Fig. 147
  resection of, 437
  retraction of, 413, Plate VIII
  rupture of, 360, 396, 402, 525
  shape, 344, 345
  Shrapnell's membrane, 345
  thickening of, 414, 418
  topographical relations, 345
  topography of outer surface, 345
    of inner surface, Fig. 165
  umbo, Plate VIII
Membranous sore throat, non-diphtheric, 164
Mendoza, Suarez de, 428
Ménière's disease, 516
Meningitis, 450, 472
  effect on ear, 523, 526
Metastasis in suppuration of the middle ear, 474
Meter, air-, 357, 364, 369, 370, Fig. 1
Michael's inflation experiments, 362
Middle ear, 396, Figs. 220, 221
  chronic catarrh of, 412, 418
  gouty and rheumatic diathesis, 419
  instruments, Figs. 167, 181
Migraine, 36, 37, 50
Milbury, F. S., 473
Miles, 123
"Mind cures," 299
Mirror, forehead-, 339
  -holder, 339
  throat, 5
Mittendorf, W. F., 117
Mobilization of the ossicles, 433
Mobilization of the stirrup, 443
Monod, 189
Moos, 479, 516, 523
Mouth-breathing, 58, 135, 284
Mulhall, 284
Murchison, 36
Mutes, deaf-, 134, 526
Mycomyringitis, 390
Mycosis of ear, 390
  of pharynx, 214
Mygind, 527
Myles, R. C., 202
Myringitis, 396
  parasitica, 390
Myxomata of larynx, 313
  nasal, 79

Narcosis, bromide-of-ethyl, 137-143
Nares, posterior, plugging in epistaxis, 77
Nasal abscess, 97
  acute catarrh, 21
  atrophic catarrh, 73
  atresia, 101
  carcinomata, 85
  cavities, abscess of septum nasi, 97
    anosmia, 92
    blood-tumors, 97
    bony occlusion, 81
    calculi, 82
    cancer, 85
    carcinoma, 85
    chondromata, 81
    cold in head, 21
    cystic polypi, 79
    deformities, 93, 101
    deviation of the septum, 93
    diphtheria, 174
    ecchondrosis, 81
    erectile tumors, 80
    exostosis, 81
    eye diseases from nasal affections, 116
    fibrous polypi, 79
    foreign bodies, 101
    fractures, 100
    furuncles, 91
    glanders, 90
    hæmorrhage, 76
    hyperplasias, 57
    hypertrophies, 57
    lupus, 90
    maggots, 103
    malignant neoplasms, 84, 85
    mucous polypi, 79
    occlusion, 101
    osteomata, 81
    papillomata, 80
    parosmia, 93
    perforations of septum, 95, 98
    polypi, 79
    reflexes, 121

Nasal cavities, rhinoliths, 82
    sarcomata, 84
    sense of smell, 92, 93
    supporter for nose, 89
    synechiæ, 57, 81
    syphilis, 87
    tuberculosis, 86
  disease in hay fever, 31, 33
  diseases from eye affections, 116, 117, 118
  douche, 9
    cause of inflammation of the middle ear, 9
  duct, 117, 119
  hæmorrhage, 76
  myxoma, 79
  polypi, 79
  reflex neuroses, 29, 121
  septum, 93, 97
  speculum, 4
  stenosis, 22, 44
  supporter, 89
Naso-pharyngeal diphtheria, 174, 176, 184
Naso-pharynx, 126
    climate, effect of, 126
    Eustachian tube, 59, Plate I
    fossa of Rosenmüller, Fig. 136, Plate I
    tonsil of Luschka, 134, Plate I
  diseases of, in otitis media, 398
    adenoid growths in, 134
    atrophic catarrh, 73
    diphtheria, 174
    examination, 3
    facial expression, 135
    follicular catarrh, 126
    polypi, fibromucous, 133
      fibrous, 131
    tumors, 131
    voice, 128
Nebulizers, 10, 11, 12
Neck-abscess, 241, 512
Necrosis of adjacent structures in middle-ear disease, 449, 457, 467
Neiswanger, C. S., 62
Neoplasms of larynx, 312, 320
  of nose, benign, 79
    malignant, 84, 85
Nerve, auditory, 518
  facial, 463, Figs. 209, 210, 214, 218, 220, 221
  olfactory, 92, 93
Nervous catarrh, 29
  coryza, 29
Net bandage, 500
Neuralgia of larynx, 297
  of pharynx, 243
  supra-orbital, 112
Neuroses, nasal reflex, 29, 121
  of ear, 518
  of larynx, 296
  of nose, asthmatic, 29, 30, 31, 32, 35, 37, 39, 41, 44, 45, 51
    eye disease, 121
    hyperæsthesia, 32, 34, 35
    migraine, 36, 37, 50
    reflexes in the eye, 121
    respiratory, 29
    treatment, 46, 124
  of olfaction, 92, 93
    anosmia, 92
    parosmia, 93
  of pharynx, 242
Neurotic character of hay fever, 29
Nevius light, the, 486
Newcomb, J. E., 140, 141
Newman, 325
Nieden, 120
Noises in the ear. See Tinnitus aurium
North, John, 56, 75, 165, 181
Northrup, 267, 277
Nose, 3
  diseases of, abscess of septum, 97
    accessory sinuses, 104
    affecting the eye, 116
    animate foreign bodies in, 103
    anosmia, 92
    asthma, 29, 30, 31, 32, 35, 37, 39, 41, 44, 45, 51
    carcinoma, 85
    deformities, 93, 101
    diphtheria, 174
    epistaxis, 76
    examination, 3
    foreign bodies, 101
    furunculosis, 91
    glanders, 90
    hæmatoma, 97
    lupus, 90
    maggots, 103
    nose-bleeding, 76
    ocular symptoms, 116
    ozæna, 73
    parosmia, 93
    polypi, 79
    rhinitis, acute, 21
      chronic, hypertrophic, 57
        simple, 24
    rhinoliths, 82
    sarcomata, 84
    septal perforations, 95, 98
    sexual relations, 72
    sprays, 8, 9, 10
    supporter for bridge and tip, 89
    syphilis, 87
    tuberculosis, 86
  ducts, Figs. 65, 67, 68
  examination and instruments, 3

Nose, fractures, 100
  hæmatoma, 97
  pathological conditions affecting the eye, 116
  relation to the ear, 398
Nose-bleeding, 76
Noyes, H. D., 122

Occlusion of nasal cavities, 101
Occupations, influence of, 331
  classified, 331
O'Dwyer, Joseph, 270, 273
Œdema of eyelids from nasal disease, 121
  glottidis, 292
  of larynx, 292, 326
  of pharynx, 160
  of uvula, 216
Ohmann-Dumesnil, A. H., 217
Olfaction, neuroses of, 92, 93
Olfactory nerve, 92, 93
Ollier, 133
Operations, asepsis in, 66
Ophthalmia, gonorrhœal, from nose, 120
Optic nerve, compression of, from ethmoid disease, 121
  sphenoid disease, 112
Orbital cellulitis, 120
Ossicles, auditory, Figs. 165, 170, 189, 192, 220, 221
  articulation, Figs. 165, 170, 192, 220, 221
  caries of, 446, 459
  chronic aural catarrh, 412, 418
  excision of, 437, 439
  hook, 440
  incudo-stapedial articulation, Figs. 170, 192, 221
  vibrator, 433
Osteomata, nasal cavities, 81
Othæmatoma of auricle, 379
Otitis externa acuta, 387
    chronica, 387
    circumscripta, 388
    diffusa, 387
    parasitica, 390
  media acuta, 402
      from nasal douche, 402
      paracentesis, 406
    chronica, 412, 418
    purulenta acuta, 407
      chronica, 445
Otomycosis, 390
Otorrhœa, chronic, 445
Otoscope, massage, 342
Overtreatment, 432
Ozæna, 73
  cause of eye diseases, 120

Pachydermia laryngis, 318
Palate, Plates I, III, IV
  cleft, 218
  perforation, 229
Panas, 119
Panophthalmitis, 120
Panotitis, 515
Papillomata of larynx, 312
  of nasal cavities, 80
  pharynx, 234
Paquin, Paul, 307
Paracentesis membranæ tympani, 406
Paracusis duplicata, 519
  Willisii, 519
Paræsthesia of larynx, 297
  pharynx, 243
Paraffin injections, 101
Paralysis of auditory nerve, 522
  facial nerve, 463
  from diphtheria, 174
  larynx, 301
  pharynx, 244
Parasitic otitis externa, 390
Paresis of auditory nerve, 522
  facial nerve, 463
Park, Roswell, 325
Parke, 36
Parosmia, 93
Patton, J. Allen, 36
Pemphigus of auricle, 380
Perforation of membrana tympani, 460
  of nasal septum, 95, 98
Perichondritis of auricle, 378
Periosteum separator, 490
Pfeiffer, R., 18
Pharyngeal tonsil, 134
Pharyngitis, acute, 147
    effect on ear, 148
    treatment, 149
  chronic, 153
  follicular, 161
  following nasal cauterization, 69
  herpetica, 164
  in measles, 159
  membranous, simple, 164
  parasitic, 214
  rheumatic, 154, 156
  scarlatina, 160
  smal -pox, 161
  syphilitic, 222
  tubercular, 219
Pharyngomycosis, 214
Pharynx, 147, Plates I, III, IV
  acute inflammation, 147, 150
  anomalies and new growths, 229
  burns and scalds, 245
  deformities, 229
  dilatation, 229, 232
  diphtheria, 167

Pharynx, diverticulum, 232
  effects of nasal disease on, 162
  foreign bodies, 245
  globus hystericus, 247
  herpes, 164
  malformations, 229
  malignant disease, 235, 239
  morbid growths, 229, 234
    angioma, 238
    cystoma, 235
    fibroma, 131, 238
    innocent growths, 234
    lipoma, 238
    lymphangioma, 238
    papilloma, 234
   malignant growths, cancer, 235
    carcinoma, 235
    epithelioma, 236, 237
    lymphosarcoma, 239
    sarcoma, 239
  mycosis, 214
  neuroses, 242
   of motion, 243
   of sensation, 242
  new growths, 229
  paralysis, 244
  parasitic disease, 214
  rheumatism, 154, 156
  spasms, 243
  stenosis, 225, 227, 229, 230, 232, 240
  syphilis, 222
  tuberculosis, 219
  uvula, bifid and double, 217
   inflammation, 216
   malformations, 217
Phlebitis of sinuses, 450, 477
Phlegmonous inflammation of antrum of Highmore, 109
  of tonsils, 202
Phlyctenular disease from rhinitis, 118, 119
Phonograph, 430
Photophobia from nasal disease, 120, 121, 123
Politzer, Adam, 360, 361, 419, 516, 523
Politzerization, 368
Pollen as a cause of hay fever, 33, 42, 52
Polypi, aural, 449, 456
  cystic, nasal, 79
  mucous, of larynx, 313
  nasal, 79
  naso-pharynx, 133
Pomeroy, O. D., 437
Porcher, W. P., 299
Porter, 268
Post-nasal catarrh, 126
  vegetations, 134
Powder-blowers, Figs. 83, 144, 178
Powders, see Appendix
Preparation of patients and instruments for operations, 487, 488
Prognosis in ear diseases, 333
Prophylaxis of acute rhinitis, 24
Prudden, 167
Prussak's space, Fig. 147
Pseudodiphtheria, 167, 169
Pseudomembranous croup, 267
Psychic influence in hay fever, 39
Puech, 120
Pulling the ears, 379, 396
Pumps, air-, 366-368
Purdy, C. W., 36
Purulent otitis media, acute, 407
  chronic, 445
   pyæmia in, 450, 469
Pyle, E. W., 485
Pynchon, Edwin, 4, 84, 212

Quain, 48
Quinlan, 69
Quinquaud, 37
Quinsy, 198

Ramsey, 119
Randall, 336, 379
Ranke, 270
Ray, J. M., 536
Records of cases, 352-355
Reflex affections of the eye and nose, 121
  nose, 29, 31, 59, 81, 82, 95, 121
  voice, 300
Reflexes, laryngeal, 300
  nasal, 121
  ocular, 121
  sexual, 72
Regulators, air-, 357, 364, 369, 370, Fig. 1
Reichert, 258
Related diseases of the eye and nose, 116
Relative frequency of diseases, 332-336
Resection of drumhead, 443
Reservoirs, air-, 357, 364, 365, 366, 369, 370
Retractor, epiglottis, 255
Retractors for mastoid operations, 490
Retropharyngeal abscess, 240, Plate IV
Reynolds, A. R., 193, 194, 196, 197
Reynolds, D. S., 71
Rheumatic sore throat, 154, 156, 199
Rheumatism and gout, effects on ear, 419
Rhinitis acuta, 21
    clothing, 24

Rhinitis acuta, complications, 23
  atrophica, 73
  hypertrophica, 57
  simple chronic, 24
Rhinoliths, 82
Rhinorrhœa, 24, 27
Rhinoscopic instruments, 3-7
Rhinoscopy, 5, 6
Rhodes, J. E., 274
Rice, C. C., 75
Richards, H., 373
Richey, S. O., 419, 429, 467
Rinné's test for hearing, 349
Robinson, Beverly, 56
Roe, John O., 55, 288
Roof of tympanum, Figs. 170, 193, 219, 220, 221
Roosa, D. B. St. J., 120, 394
Rosenmüller's fossa, Plate I
Rouge, 133
Roux, 167, 187, 188
Roy, 38
Ruedo, 467
Rumbold, Thomas F., 118, 135
  Frank, 481

Sajous, Charles E. de M., 6, 55, 153, 220, 228, 288, 300
Salpingitis, Eustachian, 398
Sarcoma of larynx, 325
  of nose, 84
  of pharynx, 239
Sattler, R., 115
Saw in nasal deformities, 70, 72
Scalds of the pharynx, 245
Scarlatina, pharynx in, 160
Schadle, J. E., 139
Schaeffer, 112
Scheibe, 481
Scheppegrell, William, 71, 103
Schiff, A., 72
Schrötter, 295, 311
Schwabach's test for hearing, 348
Schwalbe, 237
Schwartze, 492, 515, 523
Schweinitz, G. E. de, 117
Sclerosis of mastoid, 481
  middle ear, 418
Scrofula, 220
Scroll-ear, 382
Sea-bathing, effect on ear, 402
Seiler, Carl, 56
Seiss, Ralph W., 55, 68, 69, 118
Semon, 136
Senn, N., 236
Septum nasi, diseases and deformities, 93, 97
  knife, 70
  perforation, 95, 98
Sequels of middle-ear suppuration, 456
Sequestra from ear, 468, 471
Serous otitis media, 412
Sex, influence, in disease, 72, 224, 331, 332, 333, 336
Sexton, Samuel, 437, 443, 466
Sexual anomalies, effects on voice, 300
Sexual organs and the nose, 72
Shäffer, 86
Sherrington, 38
Shrapnell's membrane, Fig. 118, Plate VIII
Shurly, E. L., 54, 288, 290
Singer's nodule, 319
Sinus, inferior petrosal, Fig. 193
  lateral, Figs. 190, 193, 208, 209, 212, 213, 214, 222
Sinuses, accessory, of nose, 104
  ethmoid, 109
  frontal, 112
  maxillary, 104
  sphenoid, 110
Sinus-phlebitis and sinus-thrombosis, 477
Small-pox, throat in, 161
Smell, sense of, 92, 93
Smith, A. H., 396
Smith, J. Lewis, 170, 180, 183
Snare, ear, 457
Sokolowski, 204
Solis-Cohen, J., 55, 221, 222, 311
Solutions, antiseptic, Appendix
Somers, L. A., 77
Sore throat, acute, 147
  chronic, 153
  clergyman's, 161
  common membranous, 164
  exudative, 161
  follicular, 161
  gouty, 154, 156
  granular, 161
  hypertrophic, 161
  measles, 159
  phlegmonous, 198
  rheumatic, 154, 156
  scarlet fever, 160
  small-pox, 161
Spasm of larynx, 270
  of pharynx, 243
Spasmodic croup, 296
Spear, E. D., 517, 518
Specula, aural, 341
  nasal, 4
  Siegle's pneumatic, 426
Speech in testing the hearing, 351
Sphenoid sinuses, 110
  diseases of, effect on eye, 112
  tumors, 112
Sphenopalatine ganglion, 31
Spitzka, E. C., 380
Spots, genital, in nose, 72

Sprays, 8, 12
  for middle ear, 361, 362
Spurious croup, 261
Stacke's operation, 504
Stapes, Figs. 157, 189, 192, 210, 220, 221
  mobilization of, 443
  removal of, 439-444
Statistics, 194, 196, 307, 332-336, 527
Stein, O. J., 317
Stenosis of Eustachian tube, 398, 401
  of larynx, 293, 305, 308, 310, 311
  of nasal cavities, 22, 44, 59, 81, 205, 240
  of pharynx, 225, 227, 230, 232, 240
Sterilizing instruments, 136, 177, 178, 180, 431
Strabismus from nasal disease, 121
Stridulous laryngitis, 263
Stucky, J. A., 526
Subjective sounds, 385, 391, 398, 400, 403, 415, 421, 519
Supporter, nasal, 89
Suprarenal solution, 66, 72, 77
Synechia of nasal cavities, 57, 81
Syphilis of auricle, 380
  internal ear, 517
  larynx, 308
  nasal cavities, 87
  pharynx, 222
Syphilitic stenosis of larynx, 308, 310, 311
Syringes, 385, 386

Tables, statistical, 194
Tablets, coryza, 21
  cough-, 151
  throat-, 151
Talbot, E. S., 380
Tamponing nares, 77
Teeth, carious, 104, 214
Tegmen mastoideum, Figs. 193, 214, 219, 220, 221
  tympani, Figs. 193, 214, 219, 220, 221
Temporal bone, Figs. 190, 192, 208, 209, 210, 212, 213, 214, 219, 220, 221
  caries of, 449, 457, 467
Tensor tympani, Fig. 148
  tendon of, Fig. 147
  tenotomy of, 437
Tests for hearing, 346-353
  acoumeter, 350
  Bing's test, 350
  expressions for, 346
  Galton's whistle, 350
  Gellé's test, 350
  Rinné's test, 349
  Schwabach's test, 348
Tests for hearing, speech, 351
  tuning-forks, automatic, 347
    Hartmann's, 348
  watch, 346
  Weber's method, 349
  whispers, 351
Thomas, H. M., 11, 215
Thompson, St. Clair, 27
Thorner, Max, 147, 257
Throat-tablets, 151
Thrombosis of sinuses, 450, 477
  and jugulars, 477
Tinnitus aurium, 385, 391, 398, 400, 403, 415, 421, 519
Toeplitz, Max, 215, 326, 468, 518
Tongue-depressor, 5
Tonsil, calculi, 215
  concretions, 215
  enlarged, 204
  hypertrophy of oral, 204
    pharyngeal, 134
  mycosis, 214
  of Luschka, 134
  pharyngeal, 134
  syphilis, 225
  tuberculosis, 204, 219
Tonsillitis, acute, 198
  chronic, 204
  from nasal cauterization, 69, 199
  phlegmonous, 202
  treatment, 201, 207
Tonsillotome, 208
Tonsillotomy, 207
Tonsils, acute inflammation, 198
  chronic inflammation, 204
    adenoids in vault of pharynx, 134
    aural symptoms from, 134, 199, 205, 206
    crypts of, 198, 204, 214
    treatment, 207
      anæsthetics, 207, 212
      hæmorrhage from tonsillotomy, 210, 211, 212
      hot snare, 212
      tonsillotome, 208
      tonsillotomy, 207
  hypertrophied, 204
  lacunæ of, 198, 204, 214
  large, 204
  parasites in, 214
  varieties of inflammation, 198
Toynbee's auscultation-tube, Fig. 138
Tracheotomy, 279
  choice of operation, 280
  high operation, 280
  low operation, 282
Trachoma from nasal disease, 120
  of vocal cords, 286, 292
Transfixion needles in nasal hypertrophies, 69, Plate IV

Transformer, electric, 65, 66
Transillumination. 114
Trélat, 218
Trephines, electric. 71
Tuberculin in tuberculosis, 221, 307
Tuberculocidin in tuberculosis, 221
Tuberculosis, effect on ear, 448
  larynx, 304
  nasal cavities, 86
  pharynx, 204, 219
Tumors of antrum of Highmore, 109
  auricle, 378, 379
  frontal sinus, 115
  larynx, 312, 320
  metastatic, 239
  nasal cavities, 79-81, 97
  naso-pharynx, 131, 133, 134
  pharynx, 234
Tuning-fork, automatic, 347
Turbinated bodies, Figs. 26, 27, 28, 29, 30, 55, 56, 57, 59, 60, 61, 62, 65, 68, Plates I, II, III, IV
Turk, F. B., 18
Turnbull, 531
Tympanic cavity, Figs. 220, 221
  floor of, Fig. 170
  inner wall, Figs. 220, 221
  mucous membrane, 450
  outer wall, Figs. 148, 165
Tympanum. See Tympanic cavity.
Tyrrell, Shawe, 38

Umbo of membrana tympani, Plate VIII
Urbantschitsch, 530
Uricacidæmia, 36
Uterine reflex neuroses of larynx, 300
Uvula, Plates I, III, IV
  bifid and double, 217
Uvulitis, 216

Valsalva's inflation, 360, 416, 430
Van der Poel, 141
Vaporizers, 10-15
Vapors, use of, in ear, 361, 362, 363, 364
Varicose veins in throat, 153
Variola, pharynx in, 161
Vegetable parasites in ear, 390
Vegetations in naso-pharynx, 134
Veillon, A., 198
Velum palati, Plates I, III, IV
Vertigo, 112, 121, 385, 388, 400, 401, 415, 422, 449, 467, 473, 474, 514, 515, 516, 517, 524, 525
Vestibule, Figs. 208, 212
Vibrator, ossicle, 433
Vibratory massage, 74
Virchow, Rudolph, 170, 204, 238, 318, 321, 383, 462, 533
Visual field, contraction from nasal disease, 122
Vocal cords, granulations of, 292
  trachoma, 292
Voice in laryngeal diseases, 261, 262, 269, 284, 285, 286, 287, 290, 293, 299, 300, 305, 309, 313, 321
  in nasal diseases, 23, 59, 135
  in pharyngeal diseases, 148, 162, 205, 213, 236, 239, 240
  in sexual abnormalities, 300
  reflex affections of, 300
Vulpius, 483

Wagner, Clinton, 69
Waldeyer, 212
Watch-test for hearing, 346
Wax in ear, 384
Weaver, W. H., 427
Weber nasal douche, 9
Weber's test for hearing, 349
Webster, 515
Welch, W. H., 167, 193
Whisper-test for hearing, 351
Whistle, Galton's, 350
Whitaker, H. W., 215
White, J. A., 6, 22, 49
Wilde's incision, 485
Wile, William C., 181
Witzel, 142
Wolfenden, Norris, 204, 307
Wright, Jonathan, 54
Würdemann, H. V., 425, 438
Wyman, Morrill, 32

X-ray, 85, 232

Yersin, 169

Zaufal, 476
Ziemssen, 284, 286, 322
Zuckerkandl, 94

LANE MEDICAL LIBRARY

To avoid fine, this book should be returned on or before the date last stamped below.

[illegible] 12 [illegible]

JAN [illegible] 1919

R46 Bishop, S.S.
B62 Diseases of the ear,
1904 nose and throat. 3d ed.

NAME 34693	DATE DUE
Mrs. Gifford	ret. Aug. 4, 1916
W. Durgin.	ret. Sept. 26, 1916
Ruth White	ret. Oct. 21, 1916
E. Owen	ret. Dec. 20, 1916
W. Heyman	JAN 23 1919
	FEB 11 1919
C. Booth	MAY [illegible] 1919

34693